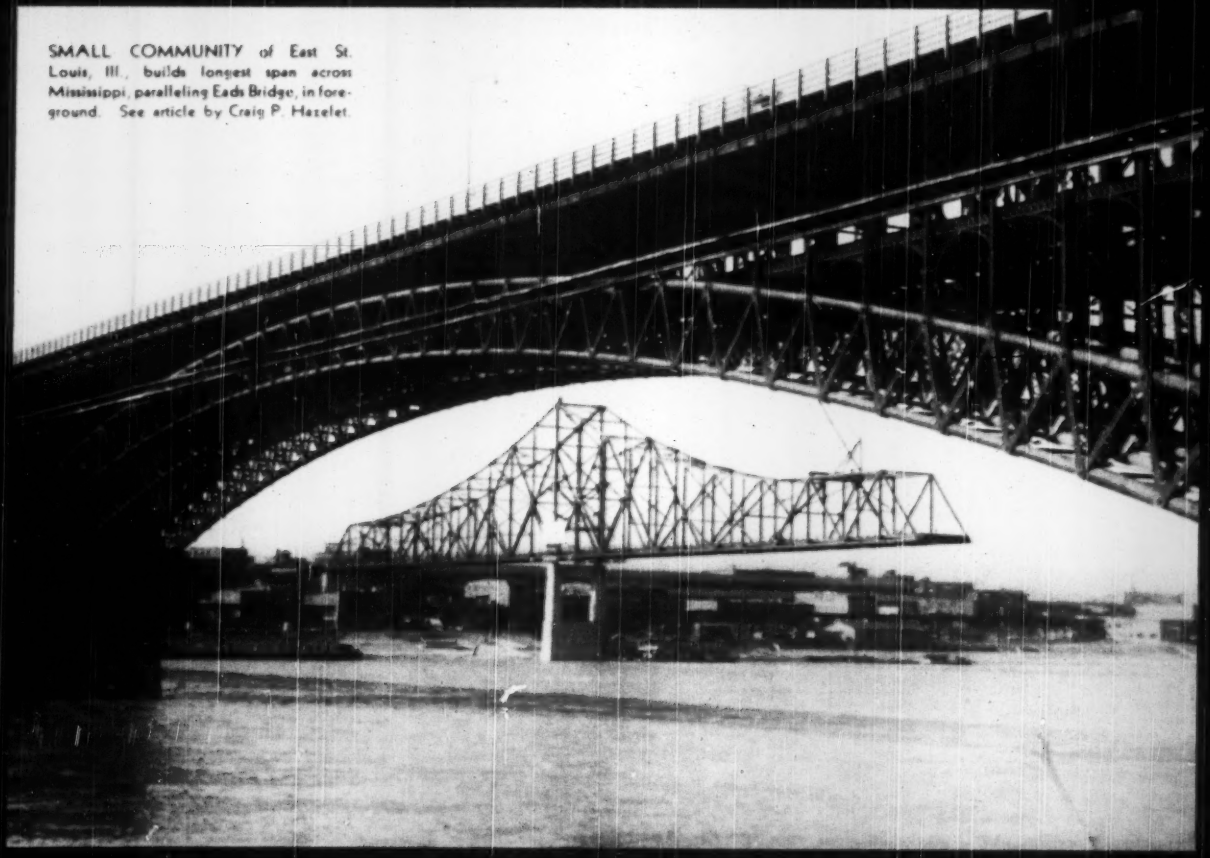
MARCH 1950

CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION



SMALL COMMUNITY of East St. Louis, Ill., builds longest span across Mississippi, paralleling Eads Bridge, in foreground. See article by Craig P. Hazelet.

Record Blast Provides 1.8 Million Yards of Rockfill for South Holston Dam—Leonard

St. Lawrence Seaway Seen as Harmful to Essential Industries and National Defense—Murrow

PROGRAM OF ASCE SPRING MEETING—LOS ANGELES, APRIL 26-29, 1950

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

DIMENSIONS FOR RAYMOND
PIPE STEP-TAPER PILES
DIAMETERS SHOWN ARE OF SHELL
TOP DIAMETERS (ARE AS UPPER SECTIONS ARE OMITTED)

Raymond

MAKES 5 TYPES OF CONCRETE PILES

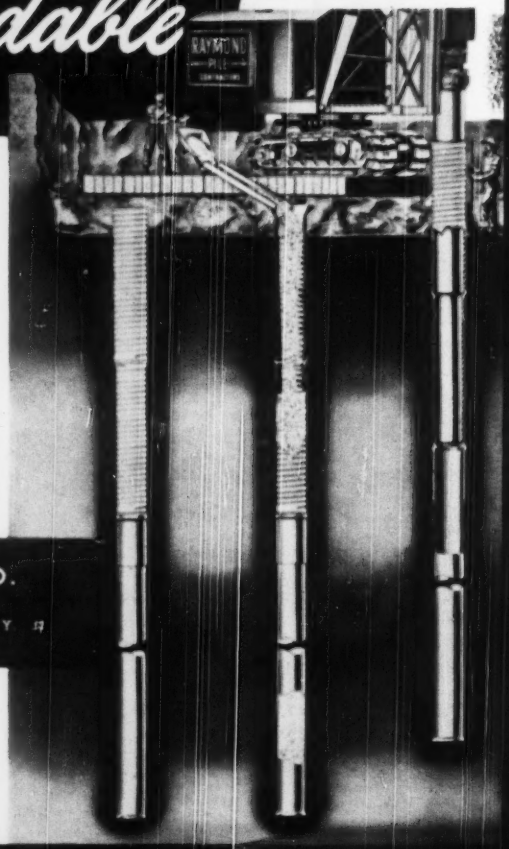
1. STANDARD . . . 2. STEP-TAPER . . . 3. PIPE STEP-TAPER
4. COMPOSITE . . . 5. GOW CAISSONS

Raymond installs every type of pile: cast-in-place concrete, precast concrete, steel pipe, wood and H-beam. Raymond operations include underpinning, borings and soil investigations, waterfront construction and harbor and river improvements; also cement mortar lining of pipes by the Centriline Corporation, a Raymond Subsidiary

3. PIPE STEP-TAPER PILES

Deep and Dependable

At the right, the pipe step-taper pile is being driven with the rapid steel mandrel. In the center the shell and pipe are being filled with concrete after having been driven to satisfactory resistance and inspected. At the left is a completed pipe step-taper pile.



Raymond Pipe Step-Taper Piles are composed of an upper section of Step-Taper Shell Pile and a lower section of closed end steel pipe pile. These piles are generally used to penetrate thick beds of soft soil to reach hard bottom at depths as great as 150 feet or more. The pipe step-taper pile is a most dependable pile available for reaching hard ground at great depths.

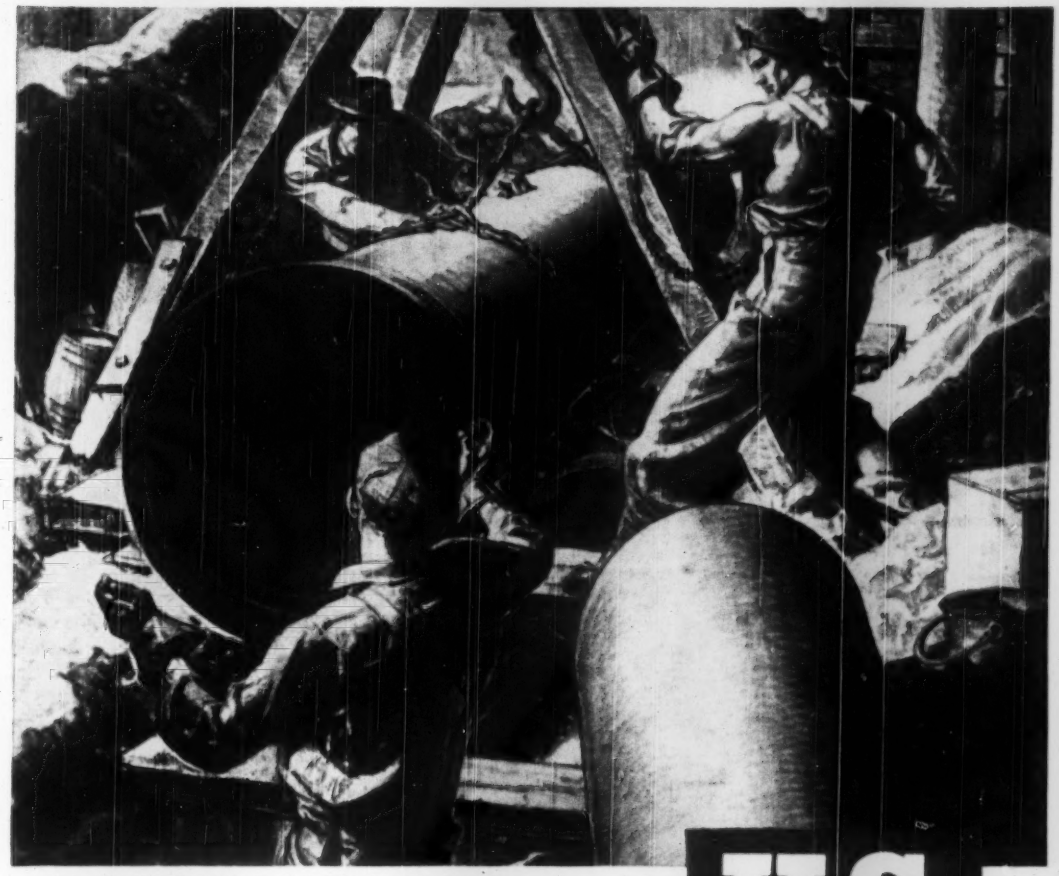
Raymond's methods result in efficiencies and substantial savings that are well worth investigating. Consult our engineers for more detailed information.

RAYMOND PILES MAINTAIN DRIVING RESISTANCE

Raymond CONCRETE PILE CO.

140 CEDAR STREET, NEW YORK 6, N. Y.

BRANCH OFFICES: Boston, Syracuse, Philadelphia, Baltimore, Washington, Pittsburgh, Atlanta, Miami, Houston, Kansas City, St. Louis, Cleveland, Chicago, Detroit, Salt Lake City, Portland, San Francisco, Oakland, Los Angeles and principal cities in Latin America



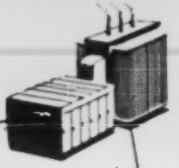
Painted for U. S. Pipe & Foundry Co. by Dean Cornwell

U.S. PIPE

You have heard it said that "cast iron pipe is cast iron pipe"—a pipe that gives dependable, long-lived, low-cost service—no matter who makes it. And that is basically a true statement. Why then do we have customers who have regularly purchased from us for over 50 years? One reason is that we have pioneered developments that have resulted in process and product improvements over the years, just as today, through research and development, we strive still further to improve our product. Another reason is that we have been able to give our customers the type of service needed to meet their particular requirements. **United States Pipe and Foundry Co., General Offices: Burlington, New Jersey. Plants and Sales Offices Throughout U.S.A.**

CIVIL ENGINEERING: March, 1950. Vol. 20, No. 3. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 West 39th Street, New York, N. Y. Price 50¢ a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage 75¢ and foreign postage $1.50 additional. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 3, 1918.

pushing the SWIFT COLUMBIA aside ... Electrically

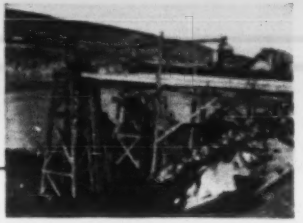


McNary Dam Contractors depend on General Electric equipment to make a success of "the toughest river diversion ever undertaken."

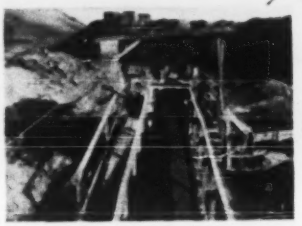
The 1953 deadline for initial generation of power at the McNary Dam project makes it an unprecedented "race against high waters." Making this deadline is a necessary step towards the alleviation of the acute power shortage in the Northwest. Because of this, the whole construction world is carefully watching the work that leads to the beginning of closure sections operations next fall. To meet this tough schedule, contractors working under contracts with the Corps of Engineers are relying on *electric drives* supplied and co-ordinated by General Electric.

Construction equipment, driven by G-E motors and control, and supplied from G-E distribution systems, will help meet your schedules with a maximum of safety, economy, and ease of maintenance. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

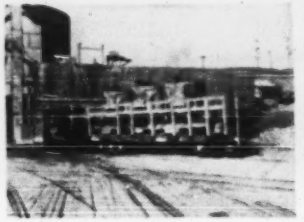
1. This G-E powered shovel handles 5 cubic yards of rock excavation with every bite. Operating from the 2400-volt a-c system, it responds instantly to the operator's touch, is easy to maintain despite rough usage.



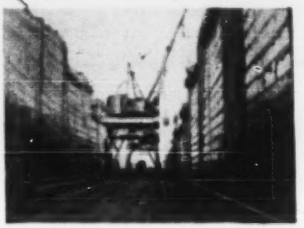
5. Deep-well pumps keep leakage from flooding the construction area. The same large Tri-Clad vertical motors driving these pumps have done yeoman service for the contractors on many previous jobs.



2. Five classes of aggregate are moved from stockpiles to batch plant on belt conveyors like this. G-E motors drive and G-E controls protect these crucial links in the concreting operations at McNary.



3. Four 25-ton G-E industrial locomotives (dinkies) move concrete—three 4-yard buckets at a time—from batch plant along a 675-foot wooden trestle at just the speed demanded by the schedule.



4. Two giant electrified revolving gantries remove buckets from railroad dinkies and place concrete in the world's highest single-lift navigation lock. Both cranes are driven by General Electric hoisting systems.

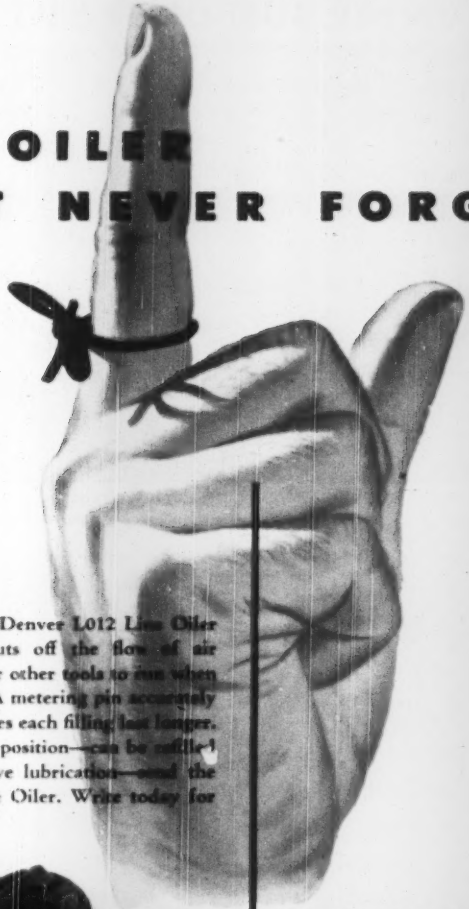
Ask him Today!

Whether you buy or build construction equipment, your G-E representative can show you how to do a better job—at lower cost—by complete electrification. Write him now, and he'll call on you at your convenience.

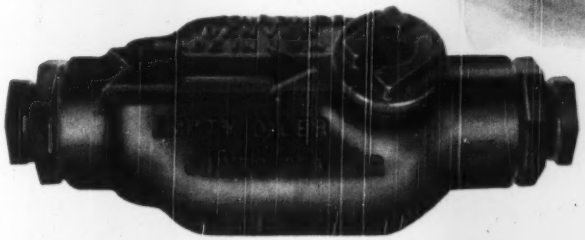
GENERAL ELECTRIC

664-8

THE OILER THAT NEVER FORGETS!



When a Gardner-Denver L012 Line Oiler runs out of oil—it automatically shuts off the flow of air through the line. No chance for drill or other tools to run when dry! You save oil, too, with the L012. A metering pin accurately regulates the flow of atomized oil—makes each filling last longer. The L012 operates equally well in any position—can be refilled without stopping the work. For positive lubrication—send the oil by air with a Gardner-Denver Line Oiler. Write today for complete information.



Gardner-Denver L012 Automatic Line Oiler—for any tool using 25 to 500 cubic feet of air per minute. Oil capacity—one pint.

OTHER GARDNER-DENVER LINE OILERS

Models L07, L08 and L09

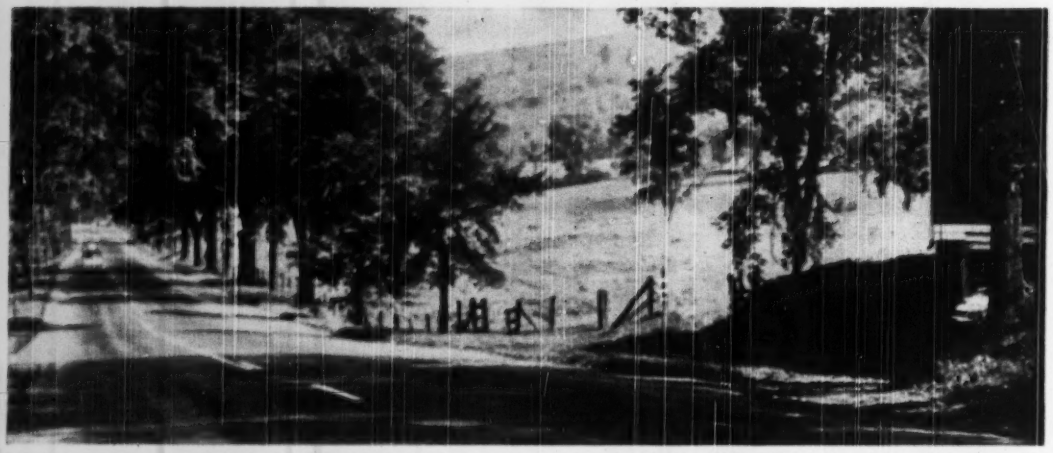
Models L011 and L014

Model	L07	L08	L09	L011	L0114
For Air Flow (Cu. Ft. per Min.)	75-450	35-200	10-75	75-450	75-450
For Use with	Large Drills	Small Drills	Air Tools	Wagon Drills	Mine Car Loaders

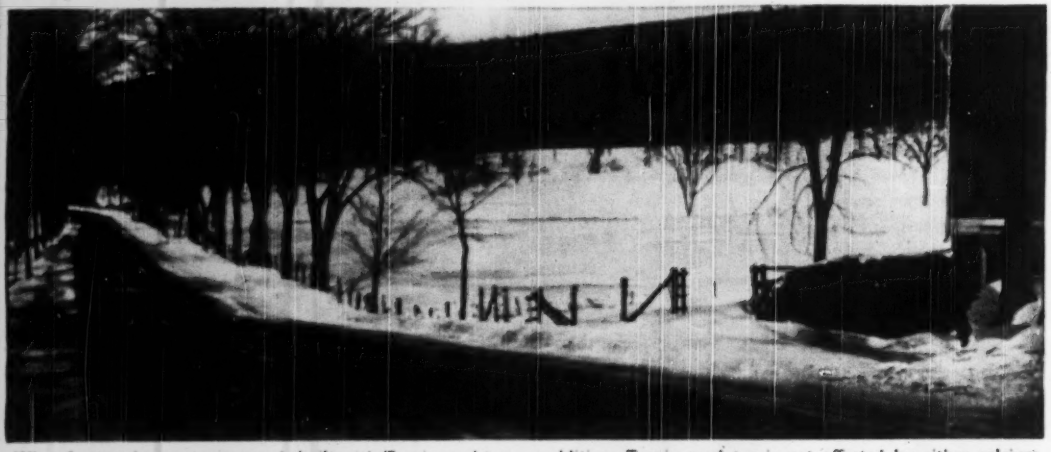
GARDNER-DENVER *Since 1859*

Gardner-Denver Company, Quincy, Illinois
In Canada:
Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

STANDS UP UNDER SUN OR FROST!



Under summer sun, roads built with Tarvia* road tar are non-glare and blend with every landscape. Moreover, they are self-healing under compacting traffic, and they will not wave, roll, push, or bleed. In addition, Tarvia* road tar roads are always easy on the eyes, and always easy to ride on.



When frost and snow comes, roads built with Tarvia road tar are easier to keep open. That's because their black surface absorbs heat—causing snow and ice to melt more readily. In addition, Tarvia road tar is not affected by either calcium chloride or sodium chloride.

Thanks to their slightly granular, "tractionized" surface, roads built with Tarvia road tar give tires a firm tread hold.

Barrett's 46 years of experience in road building, maintenance and repair is yours for the asking. *Ask the Barrett field man.*

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
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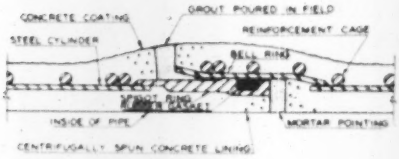
Barrett Tarvia* ROAD TAR

*Reg. U. S. Pat. Off.

CONSIDER THESE ADVANTAGES OF AMERICAN CONCRETE CYLINDER PIPE

—for main water transmission lines



Manufactured in diameters of 14" through 42" in nominal laying lengths of 30', and for operating pressures from 100 psi upward.

This composite, modified prestressed pipe —

√ Combines the physical strength and characteristics of steel with protective features and permanency of well-made concrete.

√ Will, under normal bedding and backfill conditions, successfully withstand external or trench loads up to 10 ft. of cover or more. Excessive loads are safely provided for by special bedding or backfill.

√ Has ample strength for the occasional concentrated loading which is sometimes met in practice.

√ Will remain water tight under conditions of foundation settlement or soil movement within the limits generally met in water works practice.

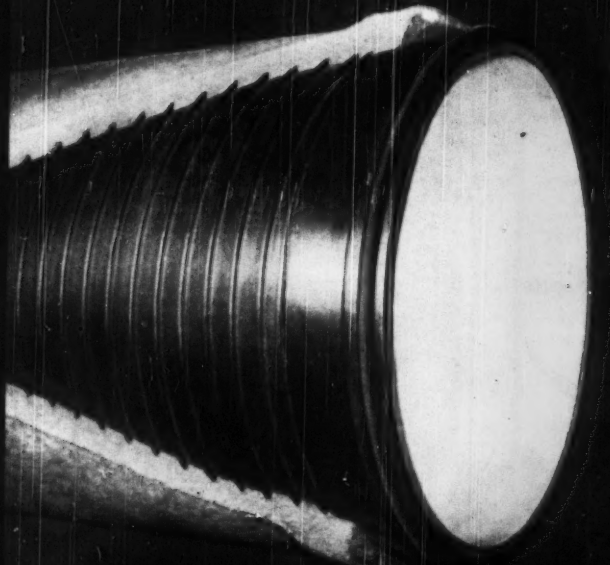
√ Has a long life with freedom from corrosion or deterioration. Concrete encasement protects steel cylinder and reinforcement from electrolytic action and deleterious ground water.

√ Has a conservative design basis and assumed unit stress which provide ample factor of safety for all normal conditions of service including surge and water hammer.

√ Will safely withstand sudden and extreme increases of pressure, or other disturbances, which might tend to burst or shatter ordinary types of pressure pipe having less elasticity.

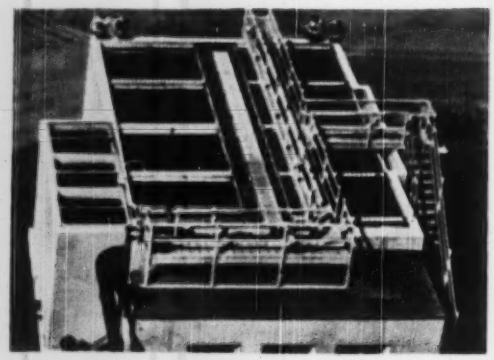
√ Has ample strength to withstand all normal handling conditions.

The economies of American Concrete Cylinder Pipe are reflected in initial cost, ease of installation, sustained capacity, and trouble-free service. These, together with the above design features, mean substantial savings in the cost of delivered water. Complete information is available upon request.



AMERICAN PIPE AND CONSTRUCTION CO.

SLUDGE BLANKET
fresh and active at all times!



• Operating on the principles of precipitation, adsorption, settling and upward filtration, the Permutit Precipitator lends itself to a variety of applications besides softening: removal of turbidity, color, taste, odor, alkalinity, silica, and fluorides.

Write for full information to The Permutit Company, Dept. CE-3, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., Montreal.

Permutit®

Water Conditioning Headquarters for over 36 years

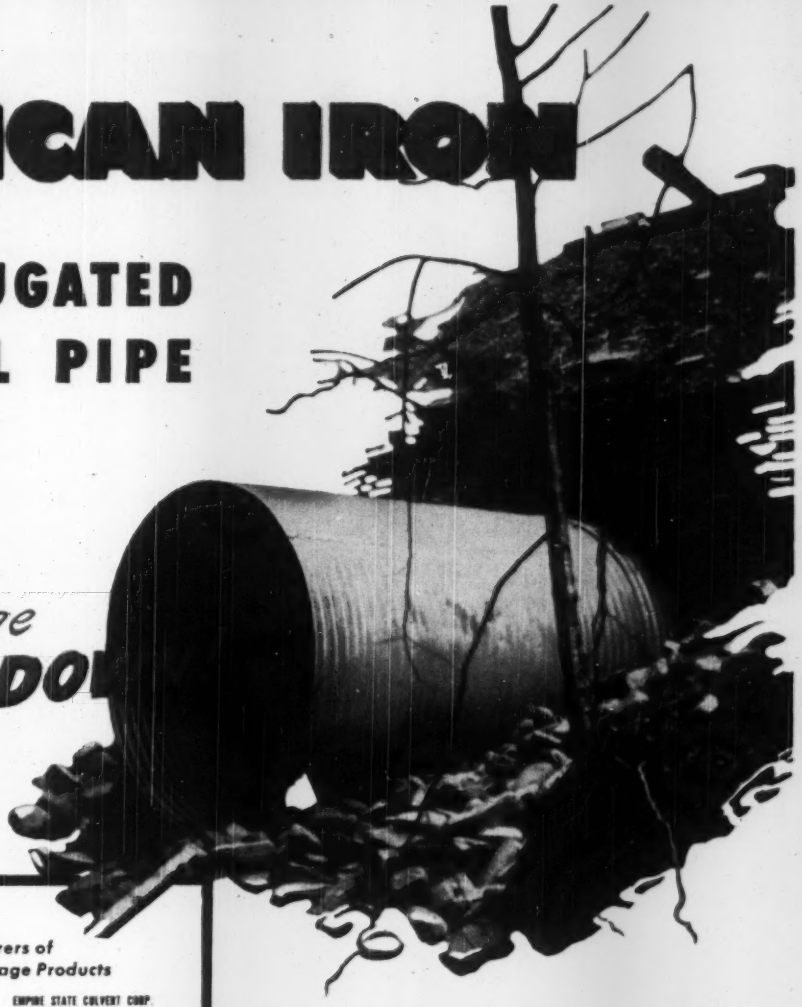
IMPORTANT OPERATING ADVANTAGES:

1. Saves you up to 50% in space
2. Saves you up to 40% in chemicals
3. Saves you up to 75% in time
4. Short detention time
5. Uniform sludge filter
6. No settling of precipitates
7. High adaptability to variable flow rates

TONCAN IRON®

CORRUGATED METAL PIPE

brings drainage costs DO



● Toncan Iron Corrugated Metal Pipe usually outlasts the road under which it is laid, because—

1. It is made from an alloyed iron containing twice as much copper as copper-bearing steels and irons *plus* molybdenum to make the copper most effective. Thus, it has the highest rust-resistance of any ferrous material in its price class.

2. It is strong and flexible, preventing cracking and crumbling under heavy loads, vibration, weather changes, earth settlement, etc.

You'll find Toncan Iron Corrugated Metal Pipe remarkably easy to install—even with unskilled labor. It is light in weight—easy to handle and haul. And it's 100% salvageable.

Want to reduce drainage costs? See your nearest Toncan Iron Manufacturer . . . or write us.

REPUBLIC STEEL CORPORATION • GENERAL OFFICES: CLEVELAND 1, OHIO

Manufacturers of Toncan Iron Drainage Products

BEALL PIPE & TANK CORPORATION
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THE BOARDMAN COMPANY
OKLAHOMA CITY, OKLA.

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Toncan Copper Molybdenum Iron is available in:

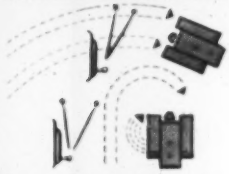
CORRUGATED METAL PIPE • PERFORATED CORRUGATED METAL PIPE • SECTIONAL PLATE PIPE
SECTIONAL PLATE ARCHES • CORRUGATED METAL PIPE-ARCH • SECTIONAL PLATE PIPE-ARCH
CORWEL SUBDRAINAGE PIPE • BITUMINOUS COATED AND PAVED PIPE

CHAMPION
the NEW

Positive all-weather starting on gasoline, with quick change over to full diesel operation, all from the seat.

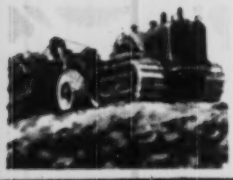
Instant speed change up or down one speed, or stop, without declutching. Planet Power drive does it!

Separate reverse lever for quick change of direction. The tractor moves in the direction the lever is moved.

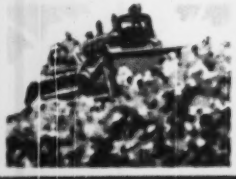


Planet Power steering puts turns with power on both tracks, feathered turns and pivot turns at your fingertips.

Self load and run with scrapers of 17-yard capacity and shift gears on the go with the rowing load.

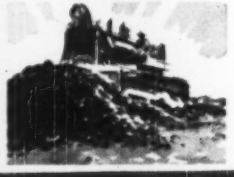


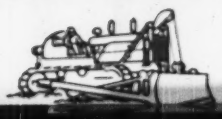
Cut waste shifting time out of work cycle... provide the best speed for every operation. 8 speeds in each direction!



Work on grades up to 100%. Its power, ground contact, balance and lubrication are right for licking any grade.

Handle heaviest loads on gradual turns as easily as straightaway because both tracks are powered in the turn!





"There Is Nothing Like The TD-24. It Can Out-Push Any Tractor On The Job."

"Here is the Champion of Crawlers," owners will tell you, "the tractor that will pull down your dirt moving costs."

Contractors and operators who have observed or operated the new International TD-24 diesel crawler are spreading the news. Here is a tractor that out-works and out-performs every other crawler known to the industry!

Operators compete with each other from Florida to Alaska to get "the big red devils," the TD-24's, assigned to them. They'll tell you no other tractor can compare with the TD-24 for ease of operation or work capacity!

# of Crawlers
INTERNATIONAL TD-24

Comfortable to ride, powerful, fast, safe and economical to operate, the TD-24 is revolutionizing ideas of what crawler tractors can or cannot do on the big jobs.

Regardless of what equipment you now use, visit your International Industrial Power Distributor and get a TD-24 demonstration. See for yourself what the TD-24 can mean to your operations in shortened time, reduced costs, extra profits.

INTERNATIONAL HARVESTER COMPANY • Chicago

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

Tune in "Harvest of Stars" with James Melton, Sundays, N. B. C.

Strong enough EMPTY to support a 100-ton rig!

MONOTUBE
tapered steel piles

cut costs, speeded construction of Nueces Bay Causeway

THIS special pile driver was designed and built to overcome the hazards of gulf storms and delay as well as to reduce the use of costly water equipment. By spanning three driven bents, it could overhang sufficiently to drive the Monotube piles in the next bent, fifty feet away. Monotubes 90 to 125 feet in length were driven in record time.

The striking feature of this ingenious operation was the way light, *empty* Monotube steel piles, without any added lateral bracing, easily supported the 100-ton driver. Monotube's additional strength gave them the extra ability to withstand the weight, vibration and pulling action of the rig . . . in other words, loads in excess of those for which they were designed. *In fact, the entire foundation was thus completely pre-tested long before the Causeway's completion and use.*

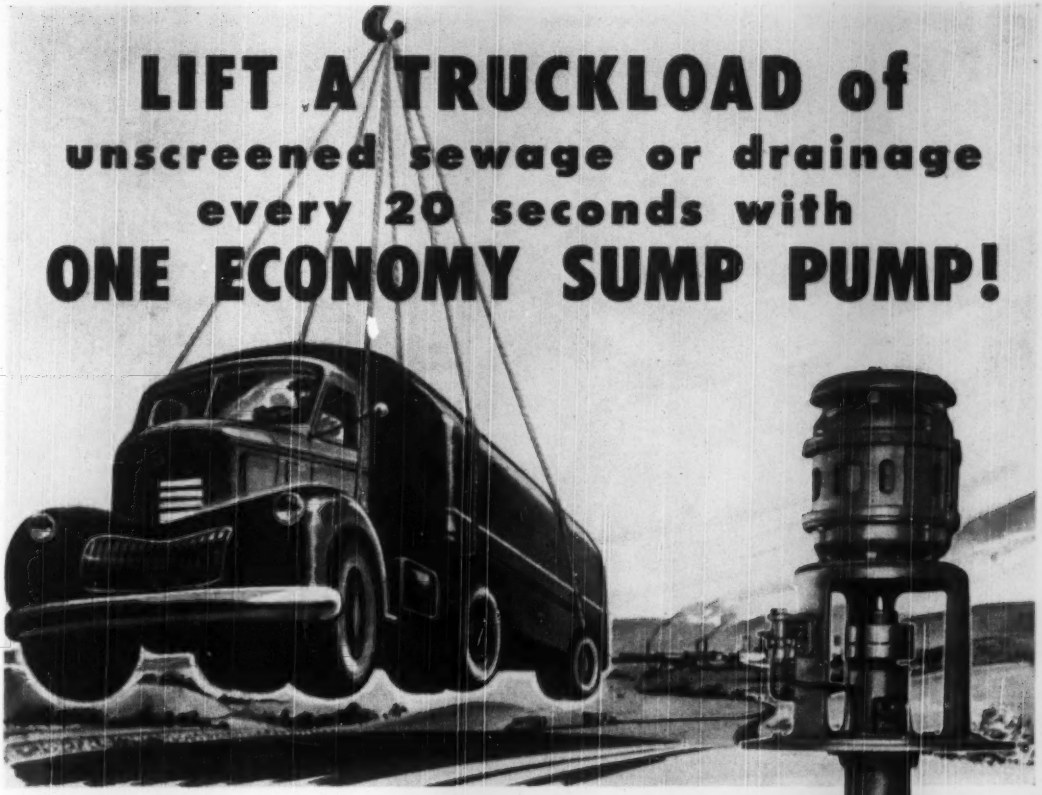
Here again Monotubes' strength, flexibility, and economy features helped solve construction problems—and reduced costs. Strong, yet light in weight, they're easy to handle. Monotubes have a range of lengths, gauges, tapers and diameters for varying soil conditions and different types of structures. There's minimum cut-off waste . . . they're easily extendible. Jobs started with Monotubes can be *completed* with them.

On foundation work of all types, Monotubes offer extra savings from start to finish. For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

Nueces Bay Causeway, Corpus Christi, Texas. Built by Texas Highway Dept., in cooperation with Bureau of Public Roads, under direction of D. C. Greer, State Highway Engineer. Contractors, Austin Bridge Co.

UNION METAL
Monotube Foundation Piles

LIFT A TRUCKLOAD of unscreened sewage or drainage every 20 seconds with ONE ECONOMY SUMP PUMP!



Up to 10,000 gallons of raw domestic and industrial sewage or drainage can be lifted by one of these Economy Sump Pumps every minute!

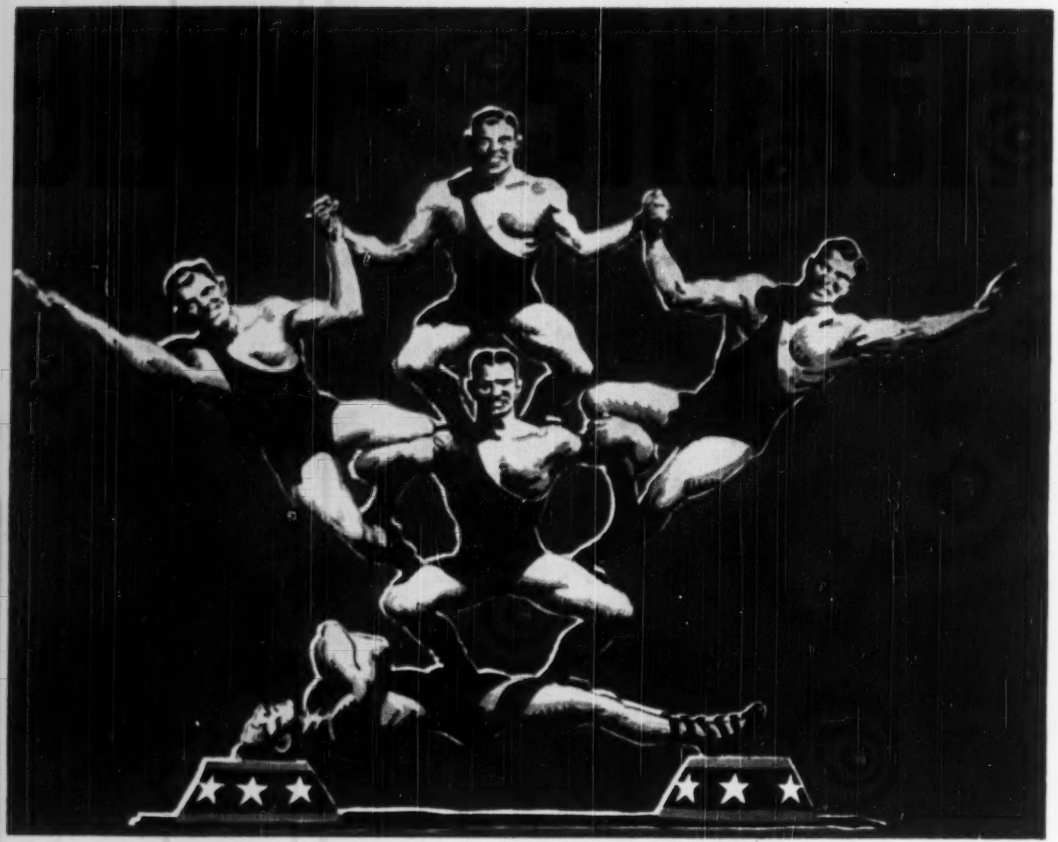
From this giant down to the smallest basement drainage unit, each Economy Sump Pump is engineered for low-cost, trouble-free performance. Impellers are non-clogging and will pass unscreened sewage with high efficiency. Eliminating screens and the usual screen-cleaning shutdowns, these pumps are economical in operation . . . use no more power than the ordinary strainer type ejector. Installation is simple and inexpensive.

- **For full details on design advantages and patented features; write Dept. BK-3 for Bulletin No. E345.**

Centrifugal, Axial, and Mixed Flow Pumps for all applications.

Economy Pumps Inc.

DIVISION OF HAMILTON-THOMAS CORP. HAMILTON, OHIO



Without beam strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in *city streets* would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada.

Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.

CAST IRON PIPE

Strength factors of Long Life !

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

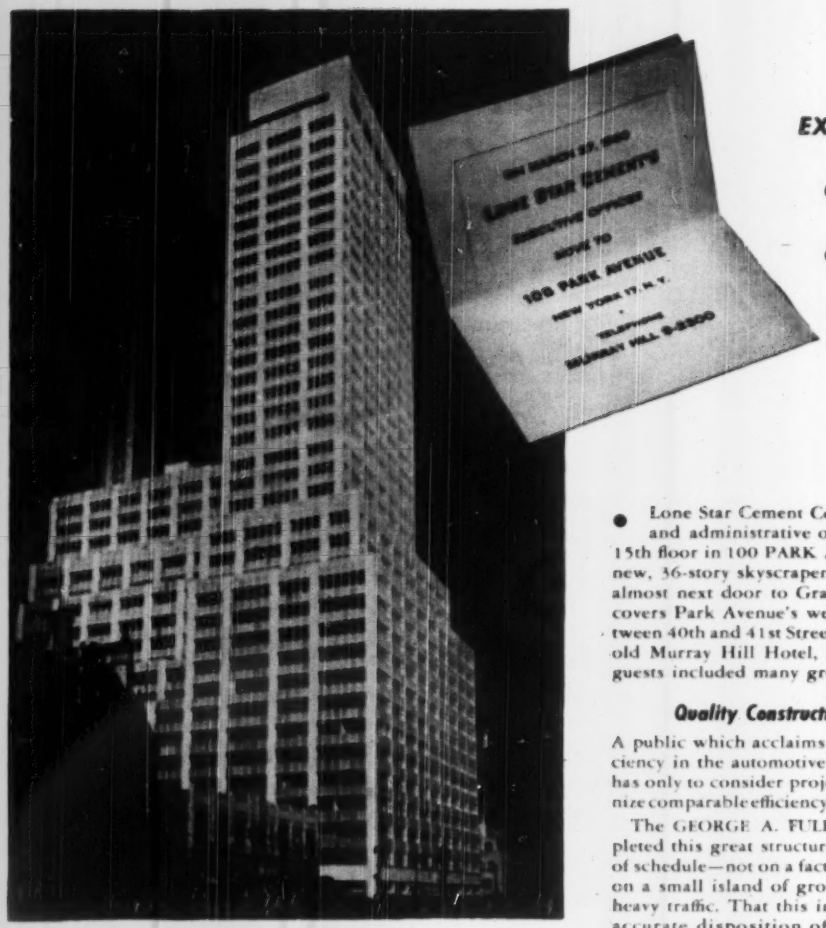
BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON

SERVES FOR CENTURIES

LONE STAR'S NEW HOME



Owner: **100 PARK AVENUE, INC.**
Architects: **KAHN & JACOBS**
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Concrete Contractor: **RIZZI CONSTRUCTION CO., INC.**
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Lone Star Cement: **GENERAL BUILDERS SUPPLY CORP.**
all of New York City

LONE STAR CEMENTS COVER THE ENTIRE CONSTRUCTION FIELD

EXECUTIVE OFFICES CONSOLIDATED ON 15th FLOOR OF NEW YORK'S NEW 36-STORY SKYSCRAPER

● Lone Star Cement Corporation's executive and administrative offices will occupy the 15th floor in 100 PARK AVENUE, New York's new, 36-story skyscraper. This great building, almost next door to Grand Central Terminal, covers Park Avenue's westerly block-front between 40th and 41st Street, on the site of famous old Murray Hill Hotel, built in 1884, whose guests included many great figures of the day.

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A public which acclaims mass-production efficiency in the automotive and other industries, has only to consider projects like this to recognize comparable efficiency in construction today.

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LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS. 15 MODERN MILLS. 27,500,000 BARRELS ANNUAL CAPACITY

MARCH 1950
VOLUME 20 NUMBER 3

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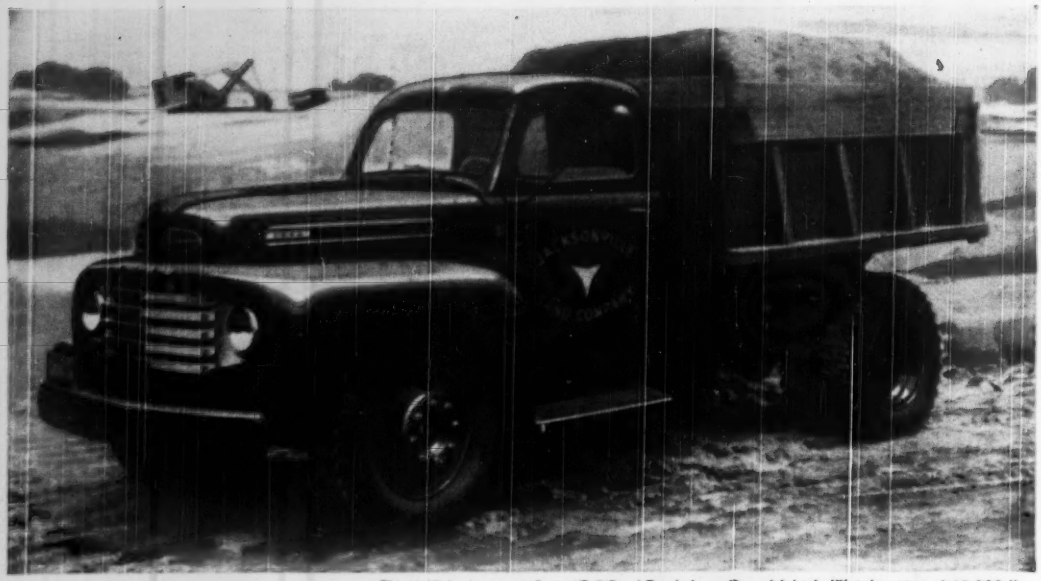

This 145-horsepower Series F-7 Ford Truck has a Gross Vehicle Weight rating of 19,000 lbs.

"We've cut sand hauling costs 30% with our Series F-7 Ford Truck" —SAYS F. M. LeGATE, Jr.

JACKSONVILLE SAND CO.
JACKSONVILLE, FLA.

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1950 Spring Meeting—Los Angeles, Calif.

American Society of Civil Engineers

Ambassador Hotel — **April 25-29, 1950**

Registration: Lobby of Ambassador Hotel, 9:00 a.m., Tuesday, April 25
Registration fee (except ladies and students) $5.00
Ticket information and reservations for all events may be obtained at registration booth.

Spring Meeting Opening Banquet—Tuesday, April 25

8:00 P.M. — **EMBASSY ROOM** — **AMBASSADOR HOTEL**

PRESIDENT R. R. SHOEMAKER of the Los Angeles Section and MAYOR FLETCHER BOWRON of the City of Los Angeles will deliver the welcoming address to the Society, to which PRESIDENT ERNEST E. HOWARD will respond.

CLARENCE A. DYKSTRA, Vice-President, University of California and Provost of U. C. L. A. will be the Principal Guest Speaker.

LEO CARILLO will be Master of Ceremonies.

Entertainment will be provided for the occasion. All members, their ladies, guests and friends of the ASCE are cordially invited to attend and enjoy this memorable event.

Ticket price will be $5.00 per plate. Dress will be informal.

Technical Division Sessions—Wednesday Morning, April 26

Air Transport–City Planning Divisions, Joint Session

9:30 A.M. — **COLONIAL (AMBASSADOR)**

Presiding: Walter Johannessen, M. ASCE, Member, Executive Committee, Air Transport Division, and Hugo H. Winter, M. ASCE, Member, Executive Committee, City Planning Division

AIRPORT PLANNING IN A LARGE METROPOLITAN AREA

9:30 Airport Planning

BRIG. GEN. WILLIAM J. FOX, Director of the Department of Aviation, County of Los Angeles, Los Angeles, Calif.

10:15 Relation of the Highway and Transit Systems to the Airport Plan

M. W. TORKELSON, M. ASCE, Director of Regional Planning, State Planning Board, The State of Wisconsin, Madison, Wis.

11:00 Economics of Airport Operation

H. A. HOOK, Chief, Airports Division, Civil Aeronautics Administration, Los Angeles, Calif.

Local Sections Conference

Monday and Tuesday—April 24 and 25, 1950

9:30 a.m. Representatives of Local Sections of ASCE in the Pacific Southwest area will assemble at the Ambassador Hotel on Monday and Tuesday, April 24 and 25, preceding the general meeting.

This Conference, which is primarily for appointed delegates of the Sections, will be open to any who may be especially interested in the activities of ASCE Local Sections.

Power Division

10:00 A.M. — **ROSE (AMBASSADOR)**

Presiding: Wallace L. Chadwick, M. ASCE, Member, Executive Committee, Power Division

POWER DEVELOPMENT TRENDS IN CALIFORNIA

10:00 Trends in Steam Power Development

J. N. LANDIS, Chief Power Engineer, Bechtel Corporation, San Francisco, Calif.

10:30 Trends in Hydroelectric Development

I. C. STEELE, M. ASCE, Vice-President and Chief Engineer, Pacific Gas & Electric Co., San Francisco, Calif.

11:00 Interconnections

NOEL B. HINSON, Vice-President, Southern California Edison Company, Los Angeles, Calif.

Engineering Economics Division

10:00 A.M. — **EL MORROCO (CHAPMAN PARK)**

Presiding: Donald M. Baker, M. ASCE, Partner, Ruscardon Engineers, Los Angeles, Calif.

10:00 Engineers and Bankers

A. J. GOCK, Chairman of the Board, Bank of America, Los Angeles, Calif.

10:30 Future Trends in Costs of Engineering Construction

GEORGE H. ATKINSON, President, Guy F. Atkinson Co., Contractors, San Francisco, Calif.

11:00 A Basis for Fees in Private Practice of Engineers

COL. WEBSTER L. BENHAM, Director, ASCE, Consulting Engineer, Benham Engineering Co., Oklahoma City, Okla.

Authors' Breakfast

Wednesday Morning, April 26, 8:30 a.m.

GOLD ROOM — **HOTEL AMBASSADOR**

For all speakers, prepared discussers and program officials.

Irrigation Division

9:30 A.M. MODERNE (AMBASSADOR)

Presiding: George D. Clyde, Assoc. M. ASCE, Chairman, Executive Committee, Irrigation Division

9:30 Definitions, Methods and Research on Consumptive Use of Water

HARRY F. BLANEY, M. ASCE, Senior Irrigation Engineer, Division of Irrigation and Water Conservation, Soil Conservation Service, U.S. Department of Agriculture, Los Angeles, Calif.

10:00 Consumptive Use of Water Along the Colorado River System

C. L. PATTERSON, Consulting Engineer, San Marino, Calif.

10:20 Consumptive Use of Water Along the Rio Grande River System

ROBERT L. LOWRY, M. ASCE, Engineer, International Boundary and Water Commission, El Paso, Tex.

11:00 Consumptive Use of Water by Forest and Range Vegetation

LOWELL C. RICH, Engineer, Southwest Forest and Range Experiment Station, Tucson, Ariz.

Wednesday Construction Luncheon

12:30 P.M. GOLD ROOM, AMBASSADOR HOTEL

All members, guests and friends of ASCE are cordially invited to attend this luncheon. A special program of concern to all related to construction will feature this event. $2.50 per plate.

11:20 Consumptive Use of Water by Irrigated Crops

W. D. CRIDDLE, Senior Irrigation Engineer, Division of Irrigation and Water Conservation Service, Soil Conservation Service, U.S. Department of Agriculture, Boise, Idaho.

11:40 Consumptive Use of Water in Municipal and Industrial Areas

GEORGE B. GLEASON, Assoc. M. ASCE, Supervising Hydraulic Engineer, State Division of Water Resources, Los Angeles, Calif.

12:00 Discussion

Structural Division

In Cooperation with Structural Engineers Association of Southern California

9:30 A.M. THEATER (AMBASSADOR)

Presiding: Stewart Mitchell, M. ASCE, Member, Executive Committee, Structural Division

9:30 The Use of Experimental Methods in Stress Analysis of Bureau Standards.

CARL N. ZANGAR, Assoc. M. ASCE, Engineer, U.S. Bureau of Reclamation, Denver, Colo.

Discussion

10:15 Photo-Reflective Experimental Stress Analysis

GERALD BOWEN, Consulting Engineer, Bowen, Rule & Bowen, Los Angeles, Calif.

Discussion

11:00 The Development of Stresses in Shasta Dam

JEROME M. RAPHAEL, Assoc. M. ASCE, Engineer, U.S. Bureau of Reclamation, Denver, Colo.

Discussion

Technical Division Sessions—Wednesday Afternoon April 26

Irrigation Division

2:00 P.M. MODERNE (AMBASSADOR)

Presiding: Harold Conkling, M. ASCE, Member, Executive Committee, Irrigation Division

2:00 Utility, Need and Construction of Underground Water Storage Reservoirs

HARVEY O. BANKS, Assoc. M. ASCE, Consulting Engineer, Los Angeles, Calif.

2:30 Groundwater Development in California

T. R. SIMPSON, M. ASCE, Engineer, California Division of Water Resources, Sacramento, Calif.

2:50 Getting Water Out of Underground Storage Reservoirs

E. W. BENNISON, M. ASCE, Editor, *Johnson National Well Drillers' Journal*, Ed. E. Johnson, Inc., St. Paul, Minn.

3:10 Research in Recharging Underground Aquifers

DEAN C. MUCKEL, Irrigation Engineer, Division of Irrigation and Water Conservation, Soil Conservation Service, U.S. Department of Agriculture, Pomona, Calif.

3:30 Recharging Underground Aquifers Through Wells

M. I. BRASHEARS, JR., Affiliate, ASCE, District Geologist, U.S. Geological Survey, Long Island, N.Y.

3:50 Experiences in Recharging Underground Aquifers in Southern California

FINLEY B. LAVERTY, M. ASCE, Chief Hydraulic Engineer, Los Angeles Flood Control District, Los Angeles, Calif.

4:10 Discussion

City Planning—Waterways Divisions, Joint Session

2:00 P.M. COLONIAL (AMBASSADOR)

Presiding: Robert R. Shoemaker, M. ASCE, President, Los Angeles Section, Member, Committee on Technical Program

2:00 History of Shoreline Development Plans for Los Angeles County

1. Santa Monica Bay

A. G. JOHNSON, Beach Design Engineer, Bureau of Engineering, City of Los Angeles, Calif.

2. Long Beach Area

WERNER RUCHTI, Director of Planning, City of Long Beach, Calif.

3:15 Mission Bay Recreational Development, San Diego

GLENN RICK, City Planning Director, City of San Diego, Calif.

3:45 How the State of California and the Coastal Counties Are Solving the Beach Erosion Problem

EDWIN C. KELTON, Beach Erosion Control Engineer, Division of Beaches and Parks, Department of Natural Resources, Sacramento, Calif.

Construction—Power Divisions, Joint Session

2:00 P.M. EL MORROCO (CHAPMAN PARK)

Presiding: A. H. Ayers, M. ASCE, Member, Executive Committee, Construction Division, and Wallace L. Chadwick, M. ASCE, Member, Executive Committee, Power Division

RIVERS OF THE WEST—MAN MADE

2:00 Diversions and Construction by Major Power Companies

H. W. HABERKORN, Assoc. M. ASCE, Engineer of Hydroelectric Construction, Pacific Gas & Electric Co., San Francisco, Calif.

2:30

W. L. CHADWICK, M. ASCE, Manager, Department of Engineering, Southern California Edison Co., Los Angeles, Calif.

3:00 The Comprehensive Development of the Colorado River

E. A. MOELTZ, M. ASCE, Regional Director, U.S. Bureau of Reclamation, Boulder City, Nev.

3:45 Design and Construction of Davis Dam

H. F. BAHMEIER, M. ASCE, Construction Engineer, U.S. Bureau of Reclamation, Denver, Colo.

Structural Division

In Cooperation with Structural Engineers Association of Southern California

2:00 P.M. THEATER (AMBASSADOR)

Presiding: Stewart Mitchell, M. ASCE, Member, Executive Committee, Structural Division

2:00 Design and Construction of the Hollywood Parkway Structures, Los Angeles, California

LEONARD C. HOLLISTER, M. ASCE, Bridge Engineer, Division of Highways, California Department of Public Works, Sacramento, Calif.

Symposium on Research Data and Pacific Coast Design Methods, Diaphragms for Resistance of Seismological Forces and for Shear Distribution

3:00 Introduction and Remarks on Status of Diaphragm Design Development

JOHN G. CASE, Assoc. M. ASCE, Consulting Structural Engineer, Los Angeles, Calif.

3:10 Diaphragms of Light Steel

CARL B. JOHNSON, Assoc. M. ASCE, Johnson & Minasian, Structural Engineers, Los Angeles, Calif.

3:25 Diaphragms of Timber

CHARLES PETERSON, Superintendent, Structural Department, State Department of Architecture, Los Angeles, Calif.

3:45 Diaphragms of Reinforced Concrete

JOHN D. MENDENHALL, Assoc. M. ASCE, Ralph Parsons Company, Los Angeles, Calif.

4:00 Robertson Steel Decks as Diaphragms

S. B. BARNES, M. ASCE, Consulting Structural Engineer, Los Angeles, Calif.

4:15 Discussion

Spring Meeting Dinner-Dance—Wednesday, April 26

COCOANUT GROVE, AMBASSADOR HOTEL

7:00 Cocktail Hour

8:00 Dinner Hour, World-famous Cocoanut Grove

9:30 Dancing in the beautiful Cocoanut Grove to the music of, and entertainment by, Phil Spitalny and his nationally famous All Girl Orchestra

Special arrangements can be made for tables seating 8 or more persons. Members may underwrite complete tables. Orders for tables must be accompanied by a check in full and a list of guests.

The published seating list will close at 5:00 p.m., Tuesday, April 25. Tickets purchased after this hour will be assigned to tables in order of purchase. Sale of tickets will continue until 5:00 p.m., Wednesday, April 26. Ticket price will be $7.50 per plate. Dress will be semi-formal.

Technical Division Sessions—Thursday Morning, April 27

Sanitary Engineering Division

9:30 A.M. EL MORROCO (CHAPMAN PARK)

Presiding: Ray L. Derby, M. ASCE, Member, Executive Committee, Sanitary Engineering Division

9:30 The Place of the Resinous Ion Exchangers in Modern Water Treatment

W. W. AULTMAN, M. ASCE, Water Purification Engineer, Metropolitan Water District of Southern California, Los Angeles, Calif.

10:00 Symposium—Reclamation of Water

HAROLD E. HEDGER, M. ASCE, Chief Engineer, Los Angeles County Flood Control District, Los Angeles, Calif.

A. M. RAWN, M. ASCE, Chief Engineer & General Manager, Los Angeles County Sanitation District, Los Angeles, Calif.

10:40 Pollution of Streams and Underground Waters from Industrial Wastes

ARTHUR G. PICKETT, M. ASCE, Deputy County Engineer, Los Angeles County, Calif.

Sanitary Engineering Luncheon

THURSDAY, APRIL 27, 12:15 P.M.
GREEN ROOM CHAPMAN PARK HOTEL

Sponsored by Sanitary Engineering Division, featuring:

Los Angeles' New $40,000,000 Activated Sludge Plant

Speaker:
G. A. PARKS, Senior Civil Engineer, Bureau of Engineering, City of Los Angeles

Per plate $2.50

Hydraulics–Irrigation–Power Divisions, Joint Session

9:30 A.M. COLONIAL (AMBASSADOR)

9:30 Introductory Remarks on Lake Mead Sedimentation Survey, 1948–1949

C. P. VETTER, M. ASCE, Chairman, Joint Committee on Sedimentation in Reservoirs, Hydraulics Division, Senior Engineer, Bureau of Reclamation, Boulder City, Nev.

9:40 Echo Sounding as Used for Lake Mead Sedimentation Survey

W. O. SMITH, Physicist, U.S. Geological Survey, Washington, D.C.

10:10 Characteristics of Sediments in Lake Mead

HOWARD GOULD, Geologist, Department of Geology, University of Southern California, Los Angeles, Calif.

10:40 Physical and Chemical Limnology of Lake Mead

C. S. HOWARD, Affiliate, ASCE, District Chemist, U.S. Geological Survey, Quality of Water Branch, Fort Douglas, Salt Lake City, Utah.

11:10 Discussion

Soil Mechanics and Foundations Division

9:30 A.M. THEATER (AMBASSADOR)

Presiding: O. J. Porter, M. ASCE, Member, Executive Committee, Soil Mechanics and Foundations Division

9:30 Prudential Building Foundations—Borings, Samples; Lab Tests; Predictions; Design; Field Measurements; Comparison

L. T. EVANS, Assoc. M. ASCE, Consulting Engineer, Los Angeles, Calif.

9:55 Charity Hospital, New Orleans, La.—Actual Settlement as Contrasted with the Computed Settlements as Calculated from Recent Soil Borings

ROBERT F. BLAND, Jun. ASCE, Graduate Student, Tulane University, New Orleans, La.

10:20 **Experience with Bay Mud Foundations at San Francisco Airport**

GEORGE D. BURR, M. ASCE, Senior Engineer, Public Utilities Commission, San Francisco, Calif.

10:45 **Settlement of Oakland, Calif., Telephone Building**

WILLIAM W. BREWER, JR., Jun. ASCE, Dames & Moore, San Francisco, Calif.

11:10 **Summarizing discussion of foregoing papers**

WILLIAM W. MOORE, M. ASCE, Dames & Moore, San Francisco, Calif.

Surveying and Mapping Division

9:30 A.M. ROSE (CHAPMAN PARK)

Presiding: H. W. Hemple, M. ASCE, Chairman, Executive Committee, Surveying & Mapping Division

9:30 **Some Non-Military Uses of Shoran**

MILTON GLICKEN, Senior Engineer, Fairchild Aerial Surveys, Los Angeles, Calif.

Discussion

10:15 **Applications of State Plane Coordinates in County Surveys**

C. E. ARNOLD, Assoc. M. ASCE, Chief Engineer and Surveyor, Los Angeles County, Calif.

Discussion

G. M. LEATHERWOOD, Assistant District, Location Engineer, California State Highway Department, Los Angeles County, Calif.

11:00 **Arctic Mapping Surveys**

KARL B. JEFFERS, Commander U.S. Coast & Geodetic Survey, Seattle, Wash.

Waterways Division

9:30 A.M. MODERNE (AMBASSADOR)

Presiding: Robert R. Shoemaker, M. ASCE, President, Los Angeles Section, Member, Technical Program Committee

9:30 **Engineering Aspects of the State vs. Federal Government Dispute Over Tide and Submerged Lands**

GERALD C. FITZGERALD, Assoc. M. ASCE, Consulting Engineer, Los Angeles, Calif.

10:10 **General discussion**

10:20 **Recent Trends in Adapting Bulkhead and Wharf Construction to Requirements of Modern Port Facilities**

B. N. HOFFMASTER, Assoc. M. ASCE, Structural Engineer, Port of Long Beach, Calif.

11:00 **General discussion**

11:10 **The Use of Hydraulic Models in Comprehensive Port Planning**

T. J. THORLEY, Senior Harbor Engineer, Port of Long Beach, Calif.

11:50 **General discussion**

Junior Forum Luncheon—Thursday, April 27

12:00 NOON EMBASSY ROOM AMBASSADOR HOTEL

Toastmaster: Sigmund L. Levin, Jun. ASCE; Los Angeles Section Junior Forum

Welcome by Warren Curtis, Jun. ASCE, President, Junior Forum, Los Angeles Section.

A. M. RAWN, M. ASCE, Chairman of the National Committee on Salaries, will speak on

"What the Employer Wants from the Young Engineer"

In addressing the Junior Forum Luncheon, Mr. Rawn will place special emphasis on the relationship of his subject to promotions.

All members, their ladies, guests and friends of ASCE are cordially invited to attend this luncheon. Per plate, $2.50.

Technical Division Sessions—Thursday Afternoon, April 27

Soil Mechanics and Foundations Division

1:00 P.M. THEATER (AMBASSADOR)

Presiding: O. J. Porter, M. ASCE, Member, Executive Committee, Soil Mechanics and Foundations Division

2:00 **Field Study of Sheetpile Bulkhead — Layout, Instruments, Installation, Measurements, Tidal Effect, Conclusions**

C. M. DUKE, Assoc. M. ASCE, Assistant Professor of Engineering, University of California, Los Angeles, Calif.

2:25 **Discussion**

GREGORY P. TSCHEBOTARIOFF, M. ASCE, Professor, School of Engineering, Princeton University, Princeton, N.J.

2:40 **Baldwin Hills Reservoir Earth Pressure and Settlement Measurements at This Storage Dam and Reservoir**

R. R. PROCTOR, M. ASCE, Field Engineer, Department of Water and Power, Los Angeles, Calif.

3:15 **Discussion**

W. J. TURNBULL, M. ASCE, Chief, Embankment, Foundation and Pavement Division, U.S. Waterways Experiment Station, Vicksburg, Miss.

3:30 **U.S. Bureau of Reclamation Structures — Comparison Between Laboratory Test Results and Behavior of Completed Embankments and Foundations**

F. C. WALKER, M. ASCE, Head, Earth Dams Design Section, U.S. Bureau of Reclamation, Denver, Colo.

W. G. HOLTZ, M. ASCE, Head, Earth Materials Laboratory, U.S. Bureau of Reclamation, Denver, Colo.

3:55 **Discussion**

J. G. ZEITLEN, Chief, Soils Laboratory, U.S. Engineering Department, Division Office, San Francisco, Calif.

Western Region Faculty Advisers' Conference

Thursday—April 27 at 2:00 P.M.
OVAL ROOM AMBASSADOR HOTEL

Construction Division

2:00 P.M. COLONIAL (AMBASSADOR)

Presiding: A. H. Ayers, M. ASCE, Member, Executive Committee, Construction Division

RIVERS OF THE WEST—MAN MADE

2:00 **Introduction**

ROSS WHITE, M. ASCE, Vice-President, Brown & Root, Inc., Houston, Tex.

2:10 **Historical, Functional and Economies of All-American, Metropolitan and Central Valley Projects**

E. HYATT, M. ASCE, State Engineer, State of California, Sacramento, Calif.

2:45 **Construction Methods, Central Valley Canals, Mendota Canal**

O. G. BODEN, Construction Engineer, U.S. Bureau of Reclamation, Region II, Delta District, Tracy, Calif.

3:30 **Construction Features of the Canal System Grand Coulee Basin**

FRANK BANKS, Assoc. M. ASCE, Supervising Engineer, U.S. Bureau of Reclamation, Grand Coulee, Wash.

4:15 **Discussion**

Ladies Entertainment and Excursion

THURSDAY AFTERNOON AND EVENING APRIL 27, 1950

Luncheon at Bullock's, Pasadena
Visit to the Huntington Library
Visit to San Gabriel Mission
Dinner at the Huntington Hotel
Theater party at the Pasadena Playhouse

$10.00

Air Transport Division

2:00 P.M. — **ROSE (CHAPMAN PARK)**

Presiding: Walter Johannessen, M. ASCE, Member, Executive Committee, Air Transport Division

2:00 New Developments in Asphaltic Pavements for Airports

B. E. GRAY, M. ASCE, General Manager–Chief Engineer, The Asphalt Institute, New York, N.Y.

2:30 New Developments in Concrete Pavements for Airports

A. A. ANDERSON, Assoc. M. ASCE, Manager, Highways and Municipal Bureau, Portland Cement Association, Chicago, Ill.

3:00 Controlled Approach Technique

L. D. CALLAHAN, Director of Public Relations, Gilfillan Bros., Inc., Los Angeles, Calif.

Hydraulics Division

2:00 P.M. — **MODERNE (AMBASSADOR)**

2:00 Flood Flow Measurements in Natural Channels

WALTER J. WOOD, Assoc. M. ASCE, Assistant Chief, Hydraulics Division, Los Angeles County Flood Control District, Los Angeles, Calif.

2:30 Special Flow Measurements in an Artificial Penstock

MAXWELL F. BURKE, Assoc. M. ASCE, Civil Engineer, Los Angeles County Flood Control District, Los Angeles, Calif.

3:00 Special Methods of Determining Flow in Large Conduits

C. W. THOMAS, Assoc. M. ASCE, Engineer, Hydraulics Division, U.S. Bureau of Reclamation, Denver, Colo.

3:30 Discussion

Sanitary Engineering Division

2:00 P.M. — **EL MORROCO (CHAPMAN PARK)**

Presiding: Ray L. Derby, M. ASCE, Member, Executive Committee, Sanitary Engineering Division; Chairman, Spring Meeting Committee

2:00 Diatomaceous Earth Filtration

JOSEPH M. SANCHIS, Department of Water, City of Los Angeles, Calif.

JOHN C. MERRELL, JR., Jun. ASCE, Associate Sanitary Engineer, Department of Water and Power, City of Los Angeles, Calif.

Men's Dinner–Smoker Thursday, April 27

8:00 P.M. — **BALLROOM—ELKS CLUB 607 S. PARK AVENUE**

7:00– 8:00 Bottoms up at the special bar!
8:00– 9:00 Dinner
9:00–10:30 Entertainment designed to please
10:30– ? Auld Lang Syne

Send your wife on the Ladies' Tour to Pasadena and enjoy yourself to the utmost at the Men's Dinner–Smoker. There'll be everything you could ask for, including the best in food and entertainment. Plan to attend for an evening you'll never forget.

Dress will be informal, with tickets at $4.00 per plate. Students $2.00 per plate.

2:30 Are We in for a Long Draught?

FRANKLIN THOMAS, Past-President, ASCE, Professor of Civil Engineering, California Institute of Technology, Pasadena, Calif.

3:00 Status of Sewage Disposal in the San Francisco Bay Area

EDWARD A. REINKE, Assoc. M. ASCE, Chief, Bureau of Sanitary Engineering, State Department of Public Health, Berkeley, Calif.

3:30 Air Pollution Control

G. P. LARSON, Director, Air Pollution Control District, Los Angeles County, Calif.

Technical Division Sessions—Friday Morning, April 28

SUBSIDENCE OF LOS ANGELES–LONG BEACH HARBOR AREA

Joint Program with All Divisions Participating

9:30 A.M. — **THEATER (AMBASSADOR)**

Presiding: R. R. Shoemaker, M. ASCE, President, Los Angeles Section; Member, Committee on Technical Program

9:30 Introductory remarks

9:35 Subsidence in the Long Beach–Terminal Island Area

INCLUDING: History of Subsidence; Surveys; Description of Phenomena; Presentation of Illustrations of the Phenomena; Horizontal and Vertical Measurements in the Area; Recital of the Progress of All Studies to Date; Some Surface Manifestations of the Phenomena; Trends of Subsidence.

C. L. VICKERS, Assistant Harbor Engineer, Port of Long Beach, Calif.

10:00 Causes of Terminal Island–Long Beach Subsidence

INCLUDING: Geologic Structure; Oil Production; Water Production; Vibrations and Loading of the Area; Similarity to Experiences Elsewhere; Tectonic Movements Study; Most Probable Cause and Mechanics; Predication of Future Activity and Subsidence.

U. S. GRANT, Assoc. M. ASCE, Petroleum Engineer and Geologist, Department of Geology, University of California, Los Angeles, Calif.

11:00 Discussion of Subsidence from the Soil Mechanics Point of View

E. H. HARLOW, Assoc. M. ASCE, Vice-President, F. R. Harris, Inc., Consulting Engineers, New York, N.Y.

11:20 Discussion of Subsidence from the Petroleum Engineer's Point of View

CHARLES R. DODSON, Petroleum Engineer, Head of School of Petroleum Engineering, University of Southern California, Los Angeles, Calif.

Spring Meeting Dinner— Friday, April 28

7:30 P.M. — **KNOTT'S BERRY FARM** — **BUENA PARK**

This closing event for the Spring Meeting entertainment will be held at the delightful Knott's Berry Farm in Buena Park, approximately 25 miles from the convention headquarters. Chartered busses will provide transportation for nominal sum.

Your evening at Knott's is guaranteed to be a most enjoyable one with wonderful food and varying entertainment to suit everyone. After dinner, you may join the square-dancing, play cards, sing, or visit Knott's unusual and interesting "Ghost Town," containing a complete village reminiscent of pioneer days.

Dress will be informal, and the price for everything (excluding transportation) will be only $2.00 per plate. Bus transportation about $1.50.

Technical Division Sessions—Friday Afternoon, April 28

SUBSIDENCE OF LOS ANGELES-LONG BEACH HARBOR AREA

Joint Program with All Divisions Participating

1:30 P.M. THEATER (AMBASSADOR)

Presiding: R. R. Shoemaker, M. ASCE, President, Los Angeles Section, Member, Committee on Technical Program

1:30 Introductory remarks

1:35 Subsidence Problems as They Relate to Navy Installations on Terminal Island

COMMANDER L. C. COXE, Civil Engineer Corps, U.S. Navy, Long Beach, Calif.

2:05 Subsidence Problems and Remedies Applicable to Oil Field Structures

JAN LAW, Consulting Petroleum Engineer, Los Angeles, Calif.

2:35 Subsidence Problems as They Relate to Heavy Utility Installations Such as Southern California Edison Co. Steam Plant

W. L. CHADWICK, M. ASCE, Manager of Engineering, Southern California Edison Co., Los Angeles, Calif.

3:05 Special Problems Pertaining to the Raising of Ford Avenue Bridge, Terminal Island

R. HOWARD ANNIN, M. ASCE, Consulting Engineer, Los Angeles, Calif.

3:35 Variety of Past, Existing and Potential Subsidence Problems in Over-All Area Affected, and Comments on Possible Future Solutions and Economics of Problem

J. HERBERT DAVIES, M. ASCE, Consulting Engineer, Los Angeles, Calif.

4:05 General discussion

Chi Epsilon Luncheon

The newly organized Los Angeles Alumni Chapter of Chi Epsilon, Honorary Civil Engineering Fraternity, will have a luncheon for all Chi Epsilon members at 12:30 p.m., Friday, April 28, 1950, in the Coral Room of the Gaylord Hotel, adjacent to the Spring Meeting headquarters.

The cost will be $2.25 per plate.

For further information or reservations, contact the luncheon chairman, Walter Ragenovich, 2101 Parkside Ave., Los Angeles 31, Calif. (CApitol 4089).

Western Region Student Chapter Conference

AMBASSADOR HOTEL, LOS ANGELES, APRIL 27, 28, AND 29

Thursday, April 27, 7:00 p.m.

Get-Acquainted Dinner and Smoker for Society Members and Student Chapter Members.

STUDENT CHAPTER CONFERENCE

Friday, April 28—(Embassy Room)

8:30–9:30 a.m. Final registration period

9:30–9:45 a.m. Address of Welcome

CHAIRMAN: MAX KRESTON, President, Caltech Student Chapter.

Introductory remarks by G. BROOKS EARNEST, Contact Member from Board of Direction, Committee on Student Chapters.

9:45–12:00 a.m. Student Paper Contest

STUDENT PAPER CONTEST

1. **"The Queen of Arizona Highways"**
   EDWARD M. MACIAS, of the University of Arizona, representing Arizona Section.
2. **"Permafrost"**
   JOHN S. HOUSTON, of the University of Colorado, representing Colorado Section.
3. **"A New Building Block Design"**
   FARRELL MILES, of Utah State Agricultural College, representing Intermountain Section.
4. **"The Alaska Highway"**
   CEDRIC A. WHITE, of the University of Southern California, representing Los Angeles Section.
5. **"The Uses of Aerial Photographs"**
   DAVID F. ROMERO, of the University of New Mexico, representing New Mexico Section.
6. **"Nevada Looks Underground for Water"**
   WARREN E. MEACHAM, of the University of Nevada, representing Sacramento Section.
7. **Paper by representative of San Diego Section.**
8. **"The Central Arizona Project"**
   ANTON ARNOSTI, of Stanford University, representing San Francisco Section.
9. **"The Uses of Photoelasticity"**
   CHARLES S. FRAZIER, of Southern Methodist University, representing Texas Section.

12:30–2:00 p.m. Student Chapter Luncheon

TOASTMASTER: BOB SMITH, Caltech.

Accomplishments and Opportunities of the Engineering Profession

ERNEST E. HOWARD, President, ASCE.

Description of Student Chapter Conference Field Trip

DON JENNINGS and BOB PARKER, Caltech.

2:30–5:00 p.m. Student Chapter Forum

CHAIRMAN: ROBERT H. WICHMAN, President, U.S.C. Student Chapter.

Introducing the Young Engineer to Industry

HOWARD SMITH, Vice-President, Pacific Iron & Steel Co.

Comments on the Development of Western Region Student Chapters

FINLEY B. LAVERTY, Chairman, Committee on Student Chapters, ASCE.

Forum on Student Chapter Problems Including Report from Each Chapter Delegate

Report of Judges and Awarding of Prizes to Student Paper Contest Winners

8:30–12:00 p.m. Student Chapter Dance, Semi-Formal, U.S.C. Gymnasium

Host, U.S.C. Student Chapter.

Student Chapter Luncheon Friday, April 28

12:00 Noon—Embassy Room, Hotel Ambassador, $2.50 per Plate

All members are invited to attend the Student Chapter Luncheon for mutual acquaintance. President Ernest E. Howard will address the gathering.

SATURDAY, APRIL 29—FIELD TRIP

8:30 a.m. Leave Rosslyn Hotel

Student Chapter Members, both Local and Out-of-Town, to be picked up by buses for Field Trip.

9:30 a.m. Arrive at Caltech

Demonstrations in:

Hydrodynamics Laboratory (Daniel Guggenheim Aeronautical Laboratory)

High-Voltage Laboratory (High-Potential Research Laboratory)

11:30 a.m. Picnic Lunch, Tournament Park

12:30 p.m. Leave Tournament Park

1:30–4:00 Inspection of Morris Dam and Underwater Ordinance Torpedo Range of Naval Ordinance Test Station at Morris Reservoir in San Gabriel Canyon

4:15 p.m. Leave Torpedo Range for Rosslyn Hotel

HOUSING ACCOMMODATIONS have been arranged at the Rosslyn Hotel, 5th and Main Streets, Los Angeles. Double and triple rooms with bath. Student price, $1.75 per person per day. Reservations are to be made directly with Harry H. Starr, Manager, Rosslyn Hotel, 111 West 5th Street, Los Angeles 13, Calif.

Spring Meeting Ladies Program

Tuesday, April 25

Registration at the Ambassador and tours during the day in private cars.

Evening—Spring Meeting Opening Banquet.

Wednesday, April 26

Trips to the Farmers Market in private cars.

Tickets to radio programs available during the day.

Evening—Dinner-dance at the Cocoanut Grove (long dresses).

Thursday, April 27

Pasadena Day for the ladies.

Busses will leave the Ambassador at 10:30 a.m.

Lunch and fashion show at Bullock's Pasadena at 11:30 a.m. followed by a little time to shop in this unusual department store. At 2:00 p.m. the busses will leave for the Huntington Library, and later the guests will see Old San Gabriel Mission, returning to the Huntington Hotel for dinner.

In the evening busses will take the ladies to see a performance at the Pasadena Playhouse and the ladies will be returned to the Ambassador by 11:00 p.m.

Walking shoes—and a warm coat—are advisable.

Friday, April 28

Bel Air homes and gardens have been opened on this date for tours, and busses will leave the hotel at intervals from 10:30 a.m. to 2:30 p.m.

In the evening the ladies are to join the men and go by bus to Knott's Berry Farm for dinner. Here they will enjoy an informal experience in an atmosphere of early California.

Saturday, April 29

Leaving at 9:30 a.m., there is a full day's excursion by bus to Long Beach and Los Angeles Harbors with lunch at the Naval Officers Club.

Spring Meeting Excursions

Los Angeles Harbor and Terminal Island—Saturday, April 29

Busses will leave the Ambassador Hotel at 9:50 a.m. for Terminal Island via Palos Verdes Hills and the New Ford Avenue Bridge. Lunch will be served in the Officers Club at the U.S. Naval Base. Boat trip around the harbor in the afternoon will include all of Long Beach and Los Angeles harbors and the U.S. Naval Base. Busses will return to the hotel at 4:00 p.m.

Cost of excursion, $3.00.

Student Chapters—Saturday, April 29, 1950

Full details of student activities are to be mailed separately by F. B. Laverty.

An excursion has been arranged for the Student Members to visit the California Institute of Technology in Pasadena in the morning, have lunch at Tournament Park and a visit to Morris Dam in San Gabriel Canyon in the afternoon. Arrangements have been made to accommodate a limited number of Society members who may wish to attend.

Cost of excursion, $2.00.

Four Additional Trips

There will be four trips available, limited to small groups of persons who are interested in visiting the points of interest indicated. These trips will be scheduled only as they are signed for, on Wednesday, Thursday or Friday, depending on the time available. Persons interested in these trips may register for them at the registration booth.

1. Kaiser Steel Plant at Fontana. Trip includes lunch.
2. New activated sludge treatment plant being constructed at Hyperion; Los Angeles North Outfall Sewer.
3. The Metropolitan Water District's Water Softening Plant at La Verne.
4. The 200-in. telescope observatory at Mt. Palomar. Full day's trip. Lunch must be carried.

Spring Meeting Committees

Ray L. Derby, *General Chairman*
Robert R. Shoemaker, *President, Los Angeles Section*
Julian Hinds, *Director, District 11*
Franklin Thomas, *Past-President, ASCE*

Entertainment Committee
LeRoy L. Crandall, *Chairman*

Executive Committee
Ray L. Derby, *General Chairman*

Excursions Committee
Don H. McCreery, *Chairman*

Finance Committee
Burton S. Grant, *Chairman*

Hotel Committee
W. W. Hurlbut, *Chairman*

Ladies Committee
Mrs. Ray L. Derby, *General Chairman*
Mrs. George Brandow, *Vice-Chairman*

Pre-Convention Committee
Hugh Barnes, *Chairman*

Publicity Committee
Harry Hayes, *Chairman*

Reception Committee
K. C. Reynolds, *Chairman*

Registration Committee
Robert J. Hiller, *Chairman*

Student Activities Committee
Finley B. Laverty, *Chairman*

Student Chapter Conference Committee
Max Kreston, *Co-Chairman*
Robert Smith, *Co-Chairman*

Technical Committee
Trent R. Dames, *Chairman*

Transportation Committee
Ralph W. Spencer, *Chairman*

Hotel Accommodations and Meeting Headquarters

Make Hotel Reservations Early.

The Ambassador Hotel in Los Angeles is the headquarters for the Spring Meeting. Most events, unless otherwise noted, will be held in this hotel. All those planning to attend the Spring Meeting are urged to make requests for room reservations as early as possible.

To assure accommodations at the Headquarters Hotel Ambassador, requests should be received by the Hotel before April 1.

Later applicants may have to be assigned to other hotels nearby.

Rates at the Ambassador start at $7.00 a day single, and $14.00 a day double.

Requests for reservations should be mailed to:

George E. Harris, Resident Manager
Hotel Ambassador
3400 Wilshire Blvd.
Los Angeles 5, Calif.

Requests should mention your attendance at the ASCE Spring Meeting. A special request form is printed on page 86 of this issue for your convenience.

Typical Hotel Rates

Hotel	Rates	
	Single	Double
Ambassador (Headquarters)	$10.00-17.00	$10.00-17.00
Chancellor	6.00-7.00	6.50-7.50
Chapman Park	10.00 up	10.00 up
Gaylord	8.00 up	8.00 up
Mayan	4.00-5.00	4.50-6.00

St. Lawrence Seaway

Seen as Harmful to Essential Industries and a Hazard to National Defense

LACEY V. MURROW, Assoc. M. ASCE

Executive Director, Competitive Transportation Research, Association of American Railroads, Washington, D.C.

FOR MANY YEARS the St. Lawrence Seaway project has been studied and discussed by the engineering profession, as well as by politicians and the public, and many views pro and con have been expressed regarding it. In the November 1949 issue, CIVIL ENGINEERING printed a digest of the comprehensive description of the seaway by Frank P. Fifer, M. ASCE, Engineer Consultant, North Atlantic Division, Corps of Engineers, U.S. Army, presented before the Waterways Division at the ASCE Fall Meeting in Washington, D.C. Mr. Fifer's article, besides describing the project as at present constituted, gave cost estimates for the seaway as a whole and for the navigation, power and transmission developments as prepared by the Corps of Engineers. In its title, and in its general implications, the article presented the favorable side of the seaway picture. In the present article, General Murrow takes issue with the view that the project will provide cheap power and large navigation and defense benefits. His appraisal in terms of the seaway's effect on essential industries, on power, navigation and transportation in the Northeast, and on defense, will give food for thought on a matter of national significance.

THERE IS NEED for a realistic appraisal of the economics of the St. Lawrence Seaway project, particularly with reference to the claims of cheap power and navigation and defense benefits made by its proponents. In this discussion the question of power generation will be considered first.

Authorities in the field of power supply believe that there has been a great deal of erroneous thought in connection with the alleged power shortage in the northeast section of the country both during the war and currently, and that extravagant statements have been made as to what the development of the St. Lawrence would have done or will do to relieve such alleged shortages. They say nothing could be more remote from the fact than the statement that there was a power shortage during the war period. The fact is that two enormous aluminum plants were located, one within New York City and one at Massena, N.Y., during the war, purely and simply because there was available in New York State not only enough power to supply the wartime load growth but, in addition, 570,000 hp (425,000 kw) for aluminum production alone. This unique availability of capacity in New York for the one purpose of aluminum production was three-fourths of the firm capacity of the proposed St. Lawrence plant on the American side.

Admittedly there has been a lot of controversy surrounding this subject, but power authorities say that, when consideration is given to the generating capacity actually in service rather than to theoretical figures, New York State's power loads have actually been met without straining the limits of reserve generating capacity. Since the war large amounts of generating equipment have been and now are being put into service. Authentic information shows that new generating equipment is being put into commission in New York State at a faster pace than the growth of the load.

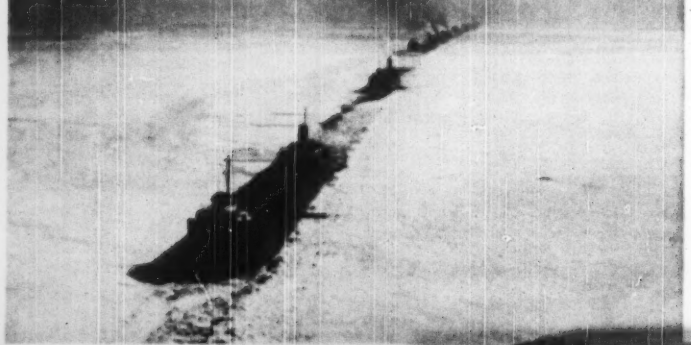
There is a basic misconception of the place which the St. Lawrence power would occupy in the general requirements of the area. The proposed plant on the American side would have a firm dependable capacity less than that of any one of several steam power plants in New York State, i.e., the Hudson Avenue plant in Brooklyn, the Waterside plant in Manhattan, the Hell Gate plant in the Bronx, and the Huntley plant in Buffalo.

In considering the actual amount of power to be obtained from the project, allowances must be made for the reduction in the normal fall of water at the powerhouse due to ice and flow conditions. The Federal Power Commission has estimated that the amount of power that it would be possible to get at all times—that is to say dependably—out of this project in so far as the United States side of the boundary is concerned, is not the 1,098,000 hp advertised, but 764,000 hp, or 570,000 kw. In comparing costs of such hydro-plant power with steam-plant power, this disparity under winter conditions must be taken into consideration.

This 764,000 hp (570,000 kw) of "primary" power is only about 10 percent of the power requirements of the State of New York at the present time and just about enough to supply the additional load which develops in

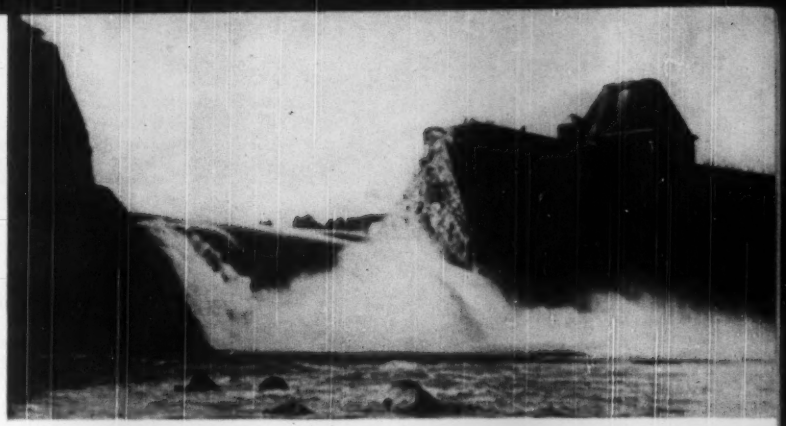
PATH CUT THROUGH ICE on Lake Erie at Buffalo, N.Y., enables iron-ore barges to set out for Cleveland, Ohio. Path through deep ice fields was cut by U.S. Coast Guard ice-breaker aided by directions from helicopter as to location of crevices and soft spots in ice. Ice conditions would tie up St. Lawrence Seaway for five months each year.

Photo from Wide World Photos, Inc.



the state in the course of two or three years. Obviously, this amount of power is not going to revolutionize the power supply of the State of New York and will be in a very literal sense "a mere drop in the bucket" as regards national requirements. The long-term reliance of the area will have to be on steam power plants.

No adequate cost estimates have as yet been made of a transmission system, large or small, that might be involved in making delivery to distant or near-by points. Estimates have been based on a purely arbitrary sample plan for transmission lines which may well be only a fraction of what would be required to accomplish the political objectives that have often been heralded for the St. Lawrence power project, namely, to spread its power supply throughout the Northeast. Such a transmission system easily might involve capital costs exceeding those for the power plant itself. Regardless of who might pay for such systems, either the federal government or others, they should be considered a part of the cost of developing and utilizing the power of the St. Lawrence.



FIVE HOURS after bombs were dropped by British Air Force, water is still pouring through breach in Moehne Dam in Ruhr Valley, Germany. Photo taken at 6:00 a.m. May 17, 1943, shows extent of damage caused to massive concrete dam by aerial attack. Hole 249 ft long was cut to depth of about 73 ft by one bomb. Similar damage to either one of two main dams in St. Lawrence Seaway project would cripple waterway for power and navigation. Photo courtesy of Joseph D. Lawin, M. ASCE.

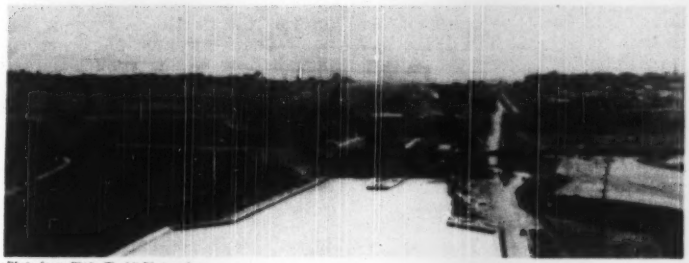


Photo from Wide World Photos, Inc.

BOTTLENECK for barge traffic from Great Lakes through St. Lawrence River is Welland Ship Canal Locks, which are limited to ultimate capacity of about 25 million tons per year.

Estimates Exclude Tax Considerations

Another misleading feature entering into the cost of St. Lawrence power is the fact that through government ownership of water-power developments taxes are avoided. Any fair comparison of costs should charge the hydro project with the taxes that an ordinary public utility corporation would have to pay, because the avoidance of taxes is just as much a subsidy as is the capital investment, and represents a loss to the public. Another misleading factor is the lower rate of interest for financing such a public project, which lower rate is brought about by the tax exemptions on a power-authority bonded interest, and by the fact that the risks are carried by the public treasury instead of by stockholders. It all boils down to a matter of obtaining power by public financing for an illusion of cheapness, or governmental subsidy, since a part of the cost is shifted onto the country's general body of taxpayers.

Assuming that there is considerable controversy about the necessity for additional hydroelectric power development, such additional development can be more economically obtained at Niagara Falls than by carrying out the St. Lawrence project. Niagara Falls is in an area where hydroelectric power is peculiarly fitted to the round-the-clock needs of local industries for low-cost energy, and the industries could use such power if produced near at hand rather than transmitted at large expense from Massena. Such power development at Niagara Falls need not be tied in with an expensive canal project. Power authorities state that a 330,000-kw development could be built in three years at an expenditure of only about $60 million. This possibility could be realized by making permanent, through treaty amendment, a temporary wartime diversion of the water on each side of the International Boundary at Niagara Falls. Early in December, the Secretary of State announced that Canada and the United States expect shortly to commence negotiations for a new treaty concerning diversions of water from the Niagara River for power purposes and for the preservation of its scenic effects. [Such a treaty was signed February 27, 1950.]

The Army Engineers' estimate of $802,566,000, at July 1948 cost levels, is merely for the 27-ft channel. The cost for the 30- or 35-ft channels is estimated at $1,048,129,000 and $1,755,079,000, respectively, which might be the ultimate cost of a waterway to take care of the "deep-draft" vessels that it is claimed would use the seaway. A 27-ft channel would permit the passage of only 8.7 percent of American flag tonnage, and the trend is towards bigger American flagships for more economical operation. The Army Engineers' estimates omit the cost of deepening the harbors and harbor approaches, the slips and dock improvements at United States and Canadian Great Lakes ports. These costs for the United States alone have been estimated at more than $200 million for a 27-ft channel; more than $300 million for a 30-ft channel; and more than $500 million for a 35-ft channel.

Engineers all recognize the probability that the actual cost of a project of the magnitude of the St. Lawrence Seaway will vastly exceed present estimates. A comparison of the estimated and actual costs of similar projects in Table I shows how great this difference can be.

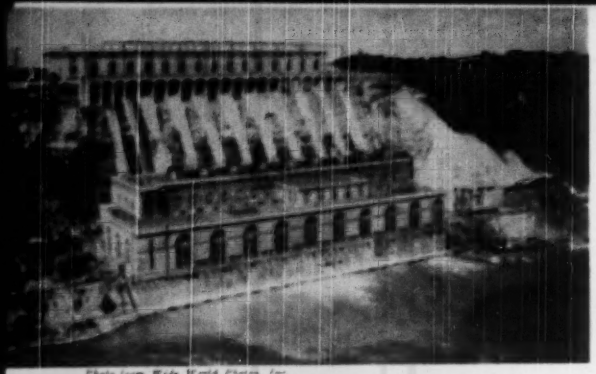


Photo from Wide World Photos, Inc.

WATERS OF NIAGARA RIVER harnessed in Chipewawa Plant of Ontario Hydro Commission, Queenstown, Canada, yield 500,000 hp. Nearby plant could develop another 450,000 hp at small fraction of cost of St. Lawrence Seaway Project.

Authorization of funds for this project would commit our country to almost as much as the federal government has spent in a century and a half on construction of seaboard harbors and channels on our three coasts. Assuredly, if in this period of carefully watched government expenditures, any such sum can be laid out by the government, it might much better be spent to help make the country economically strong for its own defense.

Estimates of Traffic Tonnage Vary Widely

Estimates of potential traffic have jumped by leaps and bounds over the period of some thirty years of agitation for the project. In 1934, the Army Engineers estimated 27 million tons, and in a report the same year the capacity of the waterway was given as only 25 million tons. In 1941, the Department of Commerce estimated 25 million tons, as late as 1947, the National St. Lawrence Association, predecessor of the Great Lakes St. Lawrence Association, estimated 37 million tons.

In "An Economic Appraisal of the St. Lawrence Project—1947," Paul M. Zeis, of the Department of Commerce's Transportation Division, estimated the potential traffic at from 40 to 54 million tons a year, which he increased to from 57 to 84 million tons in his 1948 report. He reaches these high figures by including more iron ore from Labrador Quebec than it is planned to produce, and insists on shipping, by tankers, oil which would be more likely to move by pipeline, a factor he himself has previously conceded. Mr. Zeis frankly admits that the locks now proposed would have to be paralleled by duplicate locks in order to afford anything like the capacity required to handle such a volume of traffic.

It is very interesting to note that on each occasion when the St. Lawrence project comes out of the hopper, a new traffic estimate is produced, presumably in an attempt to justify the cost. If conditions can change so rapidly and so radically, how can there be any faith in the validity of the latest estimates?

Grain, which was formerly a major item of traffic, is now down and replaced by iron ore and petroleum. It is assumed that, after discharging the ore cargoes at Buffalo, Ashtabula and Lorain, the lake carriers will go up the lakes to Port Arthur and come down grain laden, or to Gary, and thence to Chicago if grain offers itself at that point, and come down with a load. Apparently no consideration has been given to the long distance of travel in ballast between the ports of delivery of the ore and the ports of loading of the grain.

The petroleum traffic is regarded as a "potential development rather than an immediate reality." Mr. Zeis in his report states that "Actual development of this (petroleum) traffic would depend upon the availability of sufficient capacity to handle the required number of vessel passages. If ore traffic on the seaway develops as anticipated, only a very restricted capacity would remain for petroleum traffic and for vessels carrying general merchandise of all descriptions." He further states, "It is impossible to forsee what new domestic reserves of crude oil will be discovered which would invalidate any estimates of future petroleum traffic." He also intimates that the cost of transporting crude oil through the St. Lawrence seaway might be somewhat more expensive than transporting it from the Atlantic Coast through very large pipelines of the Big Inch type. It seems apparent that our national interests will best be served by encouraging to the fullest extent the development of our own oil reserves rather than by encouraging importation. And still the proponents of the project estimate from 6 to 20 million tons of petroleum traffic and over 11 million tons of general cargo traffic.

One of the most recent contentions of the project's proponents is the necessity of having the new canal for the transportation of alleged newly discovered Canadian ore as well as other foreign ore. The prospects of Canadian ore from Labrador in volume have attracted new advocates to the St. Lawrence development.

The advisability of our spending vast sums to provide a course for the importation of foreign ore, even from our Canadian neighbor, is certainly questionable, and particularly so when it would have a serious adverse effect on our own ore reserves and throttle the development, now actively under way, for the beneficiation, leading to the commercialization, of taconite.

There has been much exaggeration about the Labrador ore. The facts of the situation seem to be best set forth in a recent announcement from Montreal stating that members of the Labrador Mining and Exploration Company have just unanimously approved a proposal aimed at an extensive exploration of the iron-ore possibilities of the frozen wastes of Labrador and Ungava. The announcement further states that this exploratory venture would extend until the end of 1951 and then, if it is decided that the possibilities warrant it, certain options and leases will be exercised by the end of 1953. The second of the two-year periods would see the construction of the necessary 300 miles of railway from the ore fields to Seven Islands on the St. Lawrence River. It was stated that seven years have already been taken up by exploration and by geological and development work.

Harm to American Merchant Fleet

Officials of steamship lines have testified at Congressional hearings that they could not adjust their present services to the 7-month navigation season on the St. Lawrence, that it would be financially impossible for them to maintain the steamship services presently available to Great Lakes shippers, and consequently that

TABLE I. ESTIMATED AND ACTUAL COSTS OF SOME LARGE PROJECTS COMPARED

Project	Estimated Cost	Actual Cost	% of Increase
Bonneville Dam	$ 42,000,000	$ 80,000,000	90
Conlee Dam	13,000,000	1,50,000,000	41
Hoover Dam	70,000,000	116,000,000	66
Welland Canal	40,000,000	120,000,000	200
Chicago Drainage Canal	16,000,000	53,000,000	231
New York State Barge Canal	62,000,000	176,000,000	184

YEAR-ROUND FREIGHT SERVICE is provided by 15 railroads in area that would be served by projected St. Lawrence Seaway development. In five winter months, other modes of transportation would have to handle icebound seaway traffic. This would mean overburdening of rail facilities or else large excess capacity to be carried idle through seven summer months when seaway would be in operation.

they would not use the waterway if constructed.

The fact is that 91 percent of the American Merchant Marine would be outmoded as far as canal use is concerned if a 27-ft channel were adopted. The average draft of our vessels when fully loaded in sea water is approximately 28 ft; in fresh water it is approximately 29 ft. In order to use a 27-ft channel, the vessels would have to be loaded to draw only 24 ft. In other words, they could by no means be completely loaded and vessels which would be to a great percentage empty would be using the canal. This is obviously economically and commercially unsound. The answer to this phase of the problem certainly cannot lie in the rebuilding of our American Merchant Marine because this in itself would cost millions and millions of dollars. Even if such rebuilding were accomplished, the vessels would not be as economical or as sound for ocean voyages as those we now have. The Liberty and Victory ships, comprising by far the largest portion of the American Merchant Marine, operate at drafts impossible with a 27-ft channel.

The intended bypassing of the Atlantic and Gulf ports, with the traffic handled as it would have to be, largely by foreign, more cheaply manned vessels, would do irreparable harm to our merchant fleet, on the development of which the federal government spent more than $16.5 billion from 1916 to 1947. This fleet depends to a large extent upon the traffic moving from the Middle West to the Atlantic and Gulf ports for export the year round.

Existing Transportation Facilities Adequate

As for the railroads, if the traffic volume to be handled on the proposed waterway should come up to anywhere near the figures estimated by Army Engineers and the Department of Commerce, there would be very serious traffic diversions from the railroads, which would weaken them financially, reduce employment, curtail their purchasing power and impair their ability to make their heavy tax payments to support government. Railroad revenue losses caused by the seaway have been estimated at from $100 million to $500 million annually, including losses on coal traffic to Canada and coal movements to steam power plants. This would mean a loss to railway labor of from $50 to $125 million per year.

As it is, railroad companies are having a difficult time in meeting rising costs. The public wants improved railroad service, and the railroads are anxious to supply it. The only way it can be had is to permit the railroads to maintain their financial integrity. Privately owned, tax-paying railroads cannot live alongside of government-owned or tax-free subsidized competitors.

There is no need for additional transportation facilities. The existing railroads, highways, waterways, and airways are adequate for service between the West and the Eastern Seaboard. In this area there are 15 railroads, the New York State Barge Canal and the existing St. Lawrence Canal, all with large unused capacity.

The survival of our economic system depends upon transportation facilities that can operate continuously. The proposed waterway could only be used during 7 months of the year and would be useless during the remaining 5 winter months, or 42 percent of the year, which is why the proposed project has been designated as an "Iceway" or "The World's Greatest Part-Time Transportation Agency." This would mean that during the 5 winter months, other modes of transportation would be called upon to handle the traffic involved — with equipment which would otherwise be unnecessary or with their regular equipment greatly overburdened.

It would be uneconomical for the railroads to maintain extra capacity for standby services to handle traffic during the winter months when the waterway would be closed. The most difficult period of the year from the railroad operating standpoint is during the winter months.

With the possible exception of new ore traffic, the traffic estimated to be handled via the proposed seaway is traffic that now moves through United States ports. As a matter of fact, in their reports, the Army Engineers have carefully explained that the basis of traffic estimates is that of imports and exports moving through existing ports. If the traffic to be routed via the seaway should come up to anything like the proportions presently estimated, traffic diversions would very seriously affect the country's ports, especially New York, Baltimore, Boston, Buffalo and New Orleans.

Authorities dealing with traffic through the Port of New York have estimated that foreign traffic through this port would be cut more than one-half. Other Atlantic and Gulf ports would suffer proportionately. Such traffic losses would adversely affect public and private investments in docks, warehouses, terminals, elevators and factories and would result in large reductions in employment. Approximately one-half million persons in the Atlantic and Gulf Coast areas, whose livelihood rests directly or indirectly on this traffic, would be affected.

Proposed Tolls Too Low

Although the bill presented by Senator Lucas in the 81st Congress, in behalf of himself and 19 other Senators, includes a provision for the assessment of tolls on the traffic passing over the seaway, it provides only for further negotiations about these matters after construction is under way. Any arrangements negotiated under those conditions would be subject to the later uncertainties with respect to Congressional action and an agreement with Canada. So, if authorized, the huge expenditure could be made and later no economic justification could be shown through the assessment of tolls.

Based on the capacity of the Welland Canal, the indications are that 20 million tons would be the extreme maximum of toll-paying traffic annually for the United States and Canada combined. In the proposed Senate bill, a maximum toll charge of $1.25 per short ton has been established as the maximum charge permitted, but in all estimates by the Department of Commerce a toll of from 25 to 50 cents has been established for bulk commodities. According to the bill, tolls would apply only on traffic utilizing the new deep-water naviga-

tion works, with such exception of local or way or government traffic as may be agreed upon by the two countries. Consequently no tolls would be charged on traffic using existing canals. If we assume therefore that 80 percent of the traffic would be bulk commodities, the annual revenue from tolls might amount to the following:

16,000,000 tons at $0.50	$ 8,000,000
4,000,000 tons at $1.25	5,000,000
Total	$13,000,000

On the basis of a 27-ft channel, the annual charges to cover interest on the investment, amortization and operating costs would amount to a minimum of $25 million per year. It is therefore self-evident that on the basis of proposed legislation, the project cannot be made self-liquidating.

Tolls of an order which would provide for self-liquidation might immediately reduce traffic to a mere trickle and the seaway would be put in the position of pricing itself out of its market.

Merely to express ever so good a purpose is not to give it effect. In a free society, no government can force the use of its plants and facilities by a reluctant buying public. Until it is clearly shown that the facilities of the canal will attract traffic in sufficient volume at tolls on a level adequate, in combination with the volume, to defray the carrying charges and operating costs of the project, and that the payments for power plants are fully compensatory to the federal government, it is clearly evident that the project will not be self-liquidating despite any declaration of principle contained in the Joint Resolution. Enough has been said to indicate how grave are the doubts and how uncertain is the evidence in regard to the volume of traffic that will offer itself.

The value of the project for national defense has become quite an active issue, particularly because of the threatening situation with which the world seems to be presently confronted. Experts have testified both ways on the question, but it does not need an expert to determine the peculiar susceptibility of the project to sabotage or bombing, particularly in the light of successes in bombing German dams of the Mochne and Eder Reservoirs during World War II. In time of war, the need is for a continuous, dependable, full-time and direct means of transportation. In such times, the railroads have been and must be looked to as the first line of defense. During World War II they handled 90 percent of the war freight traffic and 97 percent of the organized movement of troops.

One of the advantages advanced by the proponents of the seaway as a defense measure is that its construction would permit the establishment of ship building and repair facilities for deep-sea vessels in a relatively secure area. It was shown, by military experts, however, that the entire premise on which this argument rests, namely, that the Great Lakes are in a "relatively secure area," is without foundation. By reason of the probability that any foreseeable future attack against the United States would come by air, using the Polar route, the Great Lakes region is actually the center of the most vulnerable one-third of the United States. The role of the Great Lakes shipbuilding facilities during the last war was to build small vessels up to and including escort destroyers and submarines. If there is any additional capacity of Great Lakes shipyards, it could easily be absorbed in building small vessels.

Another argument has been that as an additional line of communication navigable by ocean shipping, the proposed St. Lawrence waterway could, by diversion of some cargo for overseas destination, ease the strain during wartime on rail transportation and port facilities on the east and Gulf coasts. Such an argument is wholly unrealistic. In the first place, where there is a definite physical limit to the capacity of the waterway, as is the case with the St. Lawrence, there would be no ability to expand if, as its proponents claim, it will be used to capacity in peacetime—and such capacity use would be necessary if the waterway were to come even close to being economically sound.

Rail Transport Essential in Wartime

Moreover, speed is of the essence in wartime and, as has already been demonstrated, the proportion of the total traffic of the United States transported by rail increased during the Second World War as compared with other modes of transportation. Furthermore, during that war the most dire shortage of transportation was in the movement overseas of goods from our ports. This fact makes it highly unlikely that vessels capable of employment in overseas traffic would be used to parallel land transportation for more than 1,000 miles. The probabilities are that vessels normally in this trade in peacetime would be diverted to the movement of goods from our eastern ports and Gulf ports, throwing an increased burden on the railroads serving the Great Lakes area. It is a fact that vessels in coastwise, intercoastal, and Great Lakes service were diverted from these services during and just before the war, leaving their previous traffic to be carried on the railroads.

There is also the risk inherent in the vulnerability of the project. Uncontroverted testimony has been given that the two dams on which depend both the power and the navigation phases of the project could not be defended against determined air attack. Not only would the destruction of these dams render the power plant impotent, thus putting out of production all of the industrial plants dependent upon it and rendering the 27-ft canals unusable, but it would tie up for the duration of the war all vessels caught west of the break, including any deep-draft vessels which through lack of wisdom and foresight might have been under construction in the Great Lakes. Even the destruction of a single lock, either by bombing or by sabotage, would be sufficient to render the waterway unusable by deep-draft vessels.

Unfavorable Concentration of Industry

By reason of the development of the atomic bomb and the opening up of the routes over the northern Polar regions for air attack, the heavy centralization of our industry in the northern one-third of the United States, from the Great Lakes area eastward, already is a cause of much concern. The current trend in industrial mobilization planning is toward dispersion, including the proposal to place the most important factories underground. To the extent that the construction of the St. Lawrence project, and particularly the establishment of a large power plant, would lead to the establishment of new industries and increase industrial activity in this already dense area of industrial activity, the construction of the project would be counter to such trends and to the recommendations of our industrial mobilization planners.

The development of the St. Lawrence Seaway, which would retard the normal expansion of steam plants and seriously affect the expansion of rail equipment, would be adverse to the national defense interest. The greater the reliance placed on it for national defense, the greater would be the invitation to attack. It could easily become a serious weakness in a defense plan.

A project so fraught with harm to essential industries, so threatening to the peacetime prosperity and the wartime security of the United States should not be constructed regardless of cost.

Tainter Gates of Record Size Installed in Spanish Dam

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Consulting Engineer, Austin, Tex.

THE LARGEST Tainter spillway gates on record are those recently completed for the Villalcampo Dam on the Duero River in Spain, which are 78 ft 9 in. long by 36 ft 1 in. high. To lighten these structural steel gates, the writer employed inclined gate struts, which have been widely used since 1905. The pressure on each gate pin is 1,753,000 lb and the lateral thrust on each pier is 688,000 lb. Framing of the gate is shown in Fig. 1.

Piers Reinforced to Take Thrust

Piérs are reinforced to carry the thrust, which is taken by a thrust bearing of stainless steel and bronze. Each anchorage consists of twenty-three 3-in. anchor rods with threaded, upset ends, which are embedded in the concrete, transferring to it the entire thrust by bond. The nuts transfer the thrust to a steel slab carried on cast steel girders, to which the pin bearing is fastened. Gate pins are steel forgings with a stainless steel jacket.

Gate seals at each end are made of pure rubber sheet ½ in. thick. At the bottom of the gate a rubber bulb seal is used. The gate sill is aerated over its full length.

The spillway is designed to pass a maximum discharge of 275,000 cfs, or 68,750 cfs for each of the four gates.

If the gate is regarded as a three-dimensional frame, stability would require that the necessary number, m, of truss members should fulfill the relation,

$$m = 3n - 6$$

in which n is the number of joints. In this design, crossbracing between the vertical trusses was omitted altogether, thereby making the three-dimensional frame unstable. This instability has been compensated for by using guide rollers and uniform hoisting at both ends. The gates have a link chain at each end, which travels over the sprocket of a gate hoist. Each gate hoist has two wound-rotor induction motors which are electrically connected and run at synchronous speed, thereby insuring uniform hoisting.

The gates were designed by the writer for the International General Electric Co., contractors for the Hidro-Electrica Iberica of Bilbao, Spain, who furnished hydroelectric equipment for this plant in conjunction with the S. Morgan Smith Co., of York, Pa. The gates were built in Spain with the exception of the pins, pin bearing castings, seals, link chains and gate hoists, which were furnished and erected by the S. Morgan Smith Co. The latter firm also designed the gate hoists. The project is under the direction of engineer J. Ugalde, of Bilbao, Spain.

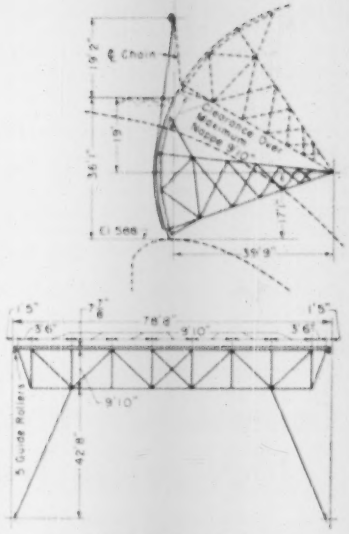
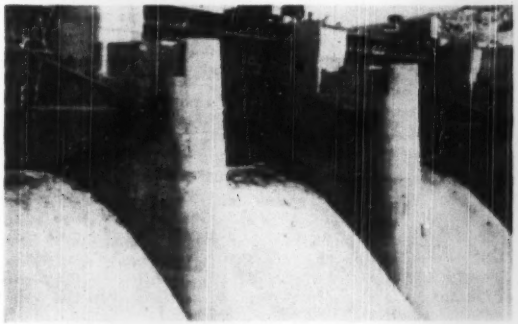


FIG. 1. RECORD-SIZE Tainter gate in Villalcampo Dam is lightened by use of inclined gate struts. Since cross-bracing between vertical trusses is omitted, resulting instability is compensated for by use of guide rollers and uniform hoisting speed at each end. Framing is seen in cross section at top, and in plan immediately above.

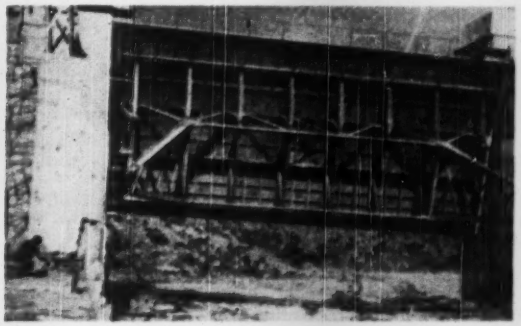
Tainter Gate Originated in France

The Tainter gate originated in France about a century ago. The oldest examples on record are the four gates built by the French engineer Poirée on a branch of the Seine River near the Mint in Paris, in the

TAINTER GATES installed in spillway of Villalcampo Dam, Duero River, Spain, have length of 78 ft 9 in. and height of 36 ft 1 in. Pressure on each gate pin is 1,753,000 lb and lateral thrust on each reinforced concrete pier is 688,000 lb. Spillway is designed to pass maximum discharge of 275,000 cfs through four gates. Gate seals at each end are of pure rubber sheet, and at bottom rubber bulb seal is used.



ONE OF structural steel Tainter gates in Villalcampo spillway is seen in open position during erection. Gates were designed for International General Electric Co., New York, contractors for Hidro-Electrica Iberica, Bilbao, Spain. Gates were built in Spain with exception of pins, pin bearing castings, seals, link chains and gate hoists, which were furnished and erected by S. Morgan Smith Co. of York, Pa.



year 1853. Poirée is also the designer of the well-known needle weir, of which many applications have been built by the U.S. Army Engineers in this country, such as the weir on the Big Sandy River near Louisa, Ky. The four Poirée gates in Paris are each 28.7 ft long by 3.3 ft high.

Another early example of the Tainter gate, built by the French engineer Mougnel Bey in the Delta Barrage on the Rosetta branch of the River Nile, was installed during the 60's. The Delta Barrage contains 64 cast-iron Tainter gates 16.4 ft wide by 16.7 ft high, with the concave side turned towards the headwater, and operated by movable hoists.

According to A. O. Powell, James B. Tainter is not the originator of this design in the United States. Instead the design is ascribed to T. Parker, originator of the Parker bear-trap gate, who is said to have sold it to Tainter. The latter was awarded patent No. 344,879, dated July 6, 1886, and must be credited with having furthered the application of this useful design in the Midwest.

Size of Gates Has Steadily Increased

Since 1890 the Tainter gate has been widely used and has steadily grown in size. Some of the earliest Tainters, built of timber, were placed in the Fox River canalization project in Wisconsin in the 90's. Numerous other early examples are to be found in Wisconsin and Michigan, such as the gates on the Illinois-Mississippi canal and on the Trowbridge and Otsego Dams on the Kalamazoo River.

Tainter head-gates for turbine penstocks were installed in the Chèvres hydroelectric plant on the Rhône River near Geneva in 1890. The largest Tainter head-gates for turbine penstocks have been designed for the Marble Falls and Granite Shoals Dams on the Colorado River in Texas. These are 45 ft wide by 29 ft high, with top seal for a 15-ft surcharge.

Comprehensive Planning Can Solve Metropolitan Transportation Problems

Abstract of Paper Presented at City Planning Division Session, ASCE Annual Meeting, New York, N.Y.

LESLIE WILLIAMS, Assoc. M. ASCE
Civil Engineer, Rye, N.Y.

WE HAVE INHERITED a great automotive industry which did not exist at the turn of the century, the collapse of which would mean the collapse of the economy under which we have to live, for we now live in a virtual AUTOPIA in the great American Kingdom of the Auto.

At the end of the first half of this century we find ourselves with over 40 million motor vehicles which roll over some 3,300,000 miles of streets and highways to the tune of some 500 billion motor-vehicle miles annually, and the bulk of these vehicles can do so and not get stuck in the mud. But the motor-vehicle deaths, personal injuries and property damage, the traffic congestion, the annual road maintenance and construction costs on our BC—Before the Car—roads are estimated to have been in the neighborhood of seven billion dollars in 1949. Roadbuilders tell us that what was paid last year is only a drop in the bucket compared to what should be spent to correct road deficiencies. "The total cost of correcting present deficiencies on the highways, roads and streets of the nation is estimated at $41,144,630,000," according to a report prepared with the cooperation of the Bureau of Public Roads and the state highway departments.

A number of public officials concerned with finding and allocating funds for highways tell us that present heavy traffic on our existing horse-and-buggy roads is pounding them to pieces faster than they can be maintained.

Thomas H. MacDonald, Hon. M. ASCE, Commissioner of the U.S. Bureau of Public Roads, tells us that, "with the marked increase in heavy loads since the end of the war, the damage to highways has become even more alarming."

Taxpayers Demand Solution to Dilemma

There is a growing impatience among taxpayers. In New York, for example, despite gasoline taxes and the other forms of revenue collected by the state and distributed back among the counties, real estate taxpayers already must finance about half the highway cost.

In some states, highway costs have already reached a disproportionate level in general expenditures. A new approach to highway construction and maintenance therefore seems necessary or, as Mr. MacDonald points out, our highways face only continuing deterioration. This is a question of cost—a very practical aspect of every planning problem. A partial answer may be found in the experience of 14 states which already have grappled with this problem of added highway commitments by applying the gross-ton-mile tax or the pay-as-you-use tax. The gross-ton-mile tax is levied on commercial users of the highway on the basis of their annual mileage multiplied by their ton loads.

What public policy are we going to adopt in planning for our future transportation needs? According to Chairman Sidney Bingham of New York's Board of Transportation, this is all a matter of point of view. In Boston recently Mr. Bingham is reported to have told the Boston transit officials that the way to operate in the black—to have a profit instead of a deficit—is to have the general public assume all costs for capital improvements and their depreciation, to be paid for out of general taxes. The revenues from transit passengers then will meet current operating costs with a little left over.

This is a neat little solution, especially if the vehicles and other capital structures wear out before their bonds are paid for. With no depreciation and obsolescence fund available, it will then be necessary to issue more bonds to buy new equipment. This method of financing will not solve the urban transport problem. The old street-car companies used it years ago and now we are having to bail them out with public money. We are seeking the road, not to nationalization of transportation, but to rationalization of transportation.

Another practical aspect to keep in mind in connection with the planning of transportation in metropolitan areas is the fact that we are dealing with a service industry. The job we have before us is one of integration, of taking out weak links and replacing them with modern facilities and adding new facilities of a type that will service the whole area. Of necessity, competitive interests will be involved which must be reconciled in the public's best interest.

The most practical approach to the problem is from comprehensive planning to detailed project. Urban transportation problems cannot be solved by piecemeal methods involving great waste, which even we in the United States cannot afford. The civil engineer in this planning process should hold a position of great responsibility.

In planning for any form of transportation, we must consider, among other things, natural resources, economics, geography, population, land utilization, plans for other community needs, the future growth and development of the whole area, the effect such plans will have upon other forms of transportation, and the welfare of the people served. Anything less is not worthy to be termed engineering—and is nothing more than wildcat speculation.

Engineers must put the force of their united strength behind comprehensive planning because comprehensive planning conserves our natural resources; enables us to get the maximum use and life out of our public structures, facilities, and transport; promotes orderly growth; insures efficient expenditure of funds; and promotes the public's health, safety, comfort, convenience, prosperity, and general welfare. Public officials, especially those with PWA experience, testify that planning reduces waste and provides more lasting benefits than hastily drawn-up projects based on snap judgment in an emergency.

The Congress of the United States is so convinced of the value of comprehensive planning that it made a general plan of the whole community a prerequisite for obtaining a loan or a grant from the 1949 Housing Act's 1.5 billion dollars for community redevelopment. If comprehensive planning is essential to proper housing, why not to transportation? The judicial branch of our government has also upheld comprehensive planning and zoning in the courts. The testimony for comprehensive planning as a modern approach is universal.

Ernest E. Howard, President of ASCE, has emphasized that the full capacities of the engineering profession will not be realized until engineering training and experience are used to their full potentials in the realm of policy making and broad planning.

To plan or not to plan is the burning question confronting leading civil engineers in this the second half of the Twentieth Century. So much depends upon engineers' decisions.

Oversimplification of Earthquake Factors Held Hazardous Design Practice

REACTION within a building due to earthquake forces is controlled in a complex way by the entire sequence of wave motions, and no simple property of the wave can be singled out as significant for practical engineering studies, the U.S. Coast and Geodetic Survey believes. So stated Capt. Elliott B. Roberts, M. ASCE, of the Survey, in his paper on "Earthquake Probabilities and Studies" delivered at the Structural Division session of the ASCE's recent Annual Meeting in New York. Incidentally, the speaker added, this is why simpler, less expensive types of instruments giving less comprehensive records are probably unsuitable for exhaustive research. Because of the complexity of earthquake motion, the inefficiency and inadequacy of the equivalent horizontal-force assumptions inherent in some existing codes, or the postulation of sustained periodic motion of arbitrary period and amplitude are apparent.

Many thoughtful and responsible engineers feel that rigorous solutions are too involved and of too limited significance and that the structural engineer must make simplifying assumptions. There is merit in this view, but it should not be allowed to lead the engineer into dangerous oversimplification of the problem.

The U.S. C. & G.S. does not intend to produce formulas necessary to the construction of earthquake-proof structures. Its sphere of investigation is limited to the following: (1) General seismological study and measurement of the probability of earthquakes; (2) determination of the effect of site and foundation conditions, as far as this effect is open to seismometric observation and excluding engineering questions such as those of soil mechanics; (3) observation and analysis of the strong ground motions; (4) descriptive surveys of earthquake damage; (5) observation of the pattern of internal vibrations of a structure as related to the seismological motions existing in the ground; and (6) cooperation in the observation and study of the response of simple oscillators to the observed motions as obtained by strong-motion seismometry (so-called spectrum studies).

Because of the billions of dollars involved in construction, it behooves the profession to promote a program of systematic research on the design factors involved in the building of structures in earthquake areas (Fig. 1). Creation of the Earthquake Engineering Research Institute is a step in the right direction.

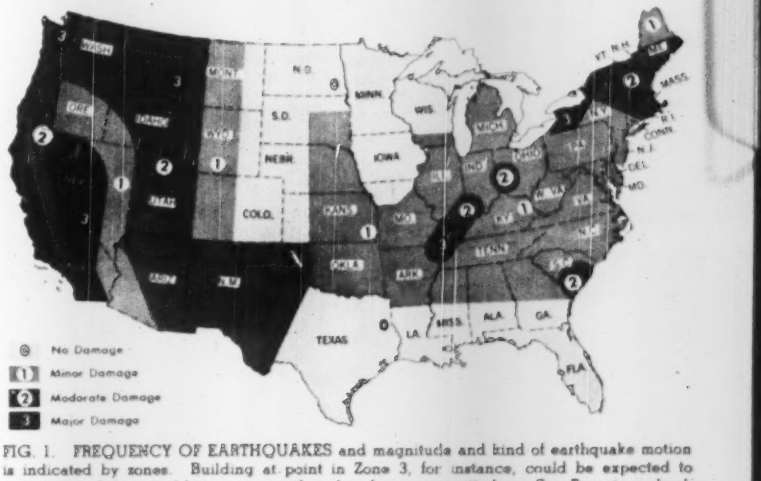
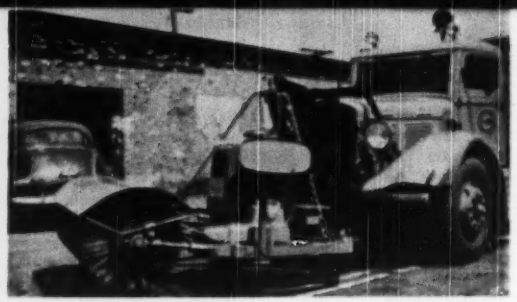


FIG. 1. FREQUENCY OF EARTHQUAKES and magnitude and kind of earthquake motion is indicated by zones. Building at point in Zone 3, for instance, could be expected to experience during its lifetime one earthquake of same magnitude as San Francisco shock of 1906. Motion may be expected in any direction, including vertical, and may also involve rotational effects.

Home-Made Equipment
Saves Connecticut's Highway Dollars

G. ALBERT HILL
State Highway Commissioner, Hartford, Conn.



ROTARY SWEEPER, which can be attached to standard snow-plow lifting unit, is used to sweep road surface prior to application of bituminous materials.

THE VAST SUMS of money needed to bring state highway systems up to an acceptable standard of safety and efficiency has, now more than ever, made it essential to stretch highway funds as far as possible. The Connecticut Highway Department has partially solved this problem by designing and building its own maintenance equipment. Much of this equipment is designed as a complete unit within itself, and may be attached or detached from either a truck or a tractor, by the setting or removal of only two or three bolts.

With the seasonal changes in maintenance tasks, the different types of equipment needed can be substituted on the same trucks or tractors as were used for the previous season's work, thus keeping these vehicles in use throughout the year.

A further advantage of this readily removable equipment is the fact that, for maintenance, it is only necessary to leave the operating unit at the shop while the truck on which it was mounted can be sent out on another job, cutting down the number of idle pieces of machinery. The equipment also serves to reduce costly hand operations, and the cost of building it is low. A brief description of some of this home-made equipment follows.

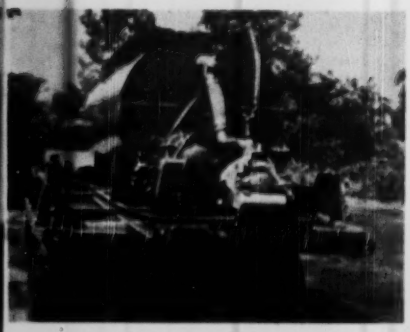
Seeding and Fertilizing Machine

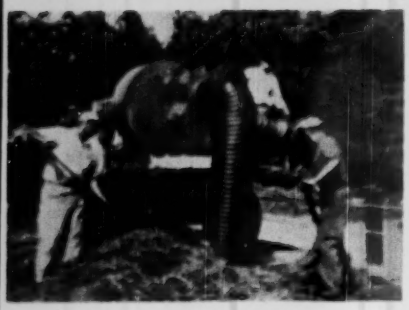
A seeding and fertilizing machine which is now in use, is equipped with a 1,000-gal steel tank with built-in agitators for mixing spray materials, a 3-in. centrifugal pump assembly, and a small 2-hp air-cooled engine. The seed and fertilizer are placed in the mixing tank by hand through an 18-in. manhole located in the top center of the tank. The entire assembly is mounted on steel I-beam skids as a unit, and can be carried readily on a 6-ton truck.

The machine is capable of fertilizing and seeding 65,000 sq ft of graded roadside from one filling in about 20 minutes. The even distribution of seed and fertilizer far surpasses that of any manual or mechanical method previously employed by the department. The density of seeding used has been 3 lb per 1,000 sq ft. However, with the excellent seed distribution obtained, $1\frac{1}{2}$ lb per 1,000 sq ft should prove adequate in the future. The cost of the first machine, including experimental work, was $2,159.51.

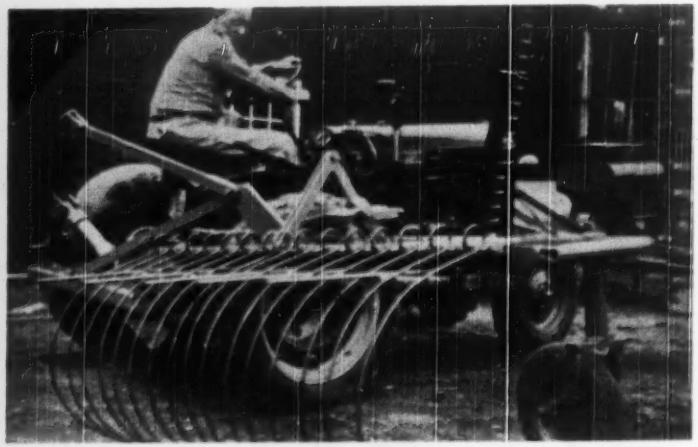
Mulch Spreader

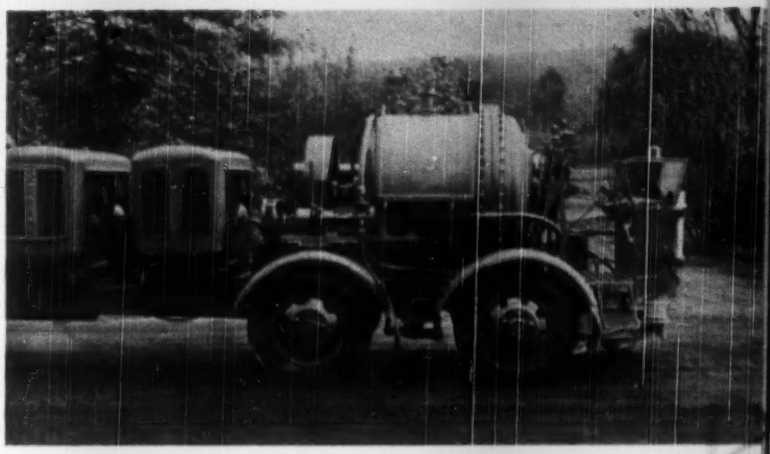
A mulch spreader, designed to spread hay mulch on roadsides after they have been seeded and fertilized, consists of a clockwise No. 450-E American blower, of the horizontal-discharge type, driven by a 6-cylinder





SEEDING AND FERTILIZING MACHINE (upper left) has 1,000-gal capacity and is capable of seeding and fertilizing 65,000 sq ft in 20 min. Mulch spreader (lower left) eliminates most of time-consuming, tedious hand labor usually required. Rake attachment (below) is designed to be attached to large highway-type tractor mowers. With this attachment, roadside growth is cut and mowed at same time, thus eliminating one costly operation. Cost of attachment is only $320.





PAVEMENT-MARKING MACHINE is capable of meeting standard marking scheme of AASHO at rate of 12 mph. Machine is result of 12 years of development of similar machines by Connecticut State Highway Department.

gasoline engine through multiple V-belts. The blower has a rated displacement capacity of 11,392 cu ft of free air, or 11,420 lb of hay mulch. The entire unit is mounted on an I-beam frame which permits easy loading and unloading, leaving the truck free for other work when it is not transporting the mulch spreader.

A 10-ft length of 18-in.-inner-diameter spiratube flexible tubing is attached to the blower inlet and a 3-ft length of 18-in. spiratube with a special nozzle attached is clamped over the discharge opening of the blower. This arrangement permits the operator to control the distribution of mulch on a slope. The unit is capable of throwing the mulch about 50 ft when using a 3-ft length of tubing. For greater distances, additional lengths of tubing are added.

To use the machine the mulch is placed in a windrow on the shoulder of the road adjacent to where it is to be placed. The truck, with spreading unit mounted on it, straddles the windrow of mulch, and the suction hose draws the mulch into the blower, whence it is thrown out over the ground.

The cost of the first machine, including experimental work, was $1,904.21. The use of this machine has reduced the cost of mulching appreciably, in addition to providing better distribution of mulch.

Tractor Rake Attachments

A rake and carrying frame constructed of seamless tubing and angle iron, attached with hinges to large highway-type tractor mowers, eliminates hand raking. The rake bar is made of $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$-in. angle iron to which tooth holders are fastened for 16 evenly spaced teeth similar to those used in a farm-type hayrake. At equal intervals five clean-out bars are fastened to the carrying frame. To dump accumulated grass and weeds, the rake bar can be lifted. The clean-out bars, being stationary, thoroughly clean the rake teeth. Rapid raising and lowering of the rake bar is accomplished by a $\frac{7}{8} \times 4$-in. hydraulic ram with special linkage operated by the engine-driven hydraulic pump.

When going over obstacles or when in traveling position, the unit is raised or lowered by a 2×10-in. ram with special linkage operated by the engine-driven hydraulic pump. A caster wheel has been installed on the outer end of the rake bar as a support for the rake bar end. By following the contour of the ground, this wheel guides the rake bar up and down, keeping it a uniform distance from the ground.

A multiple-valve control unit, composed of three operating valves and a relief valve, is installed on the tractor convenient to the operator for rapid and simple control of the hydraulic rams. The valves, each with its own control lever, have three positions—for raising, lowering, and holding. The unit is easily attached or detached from the tractor, the only connection being three pins and one hose coupling.

This attachment makes it possible to cut and rake the roadside growth in one operation, eliminating much costly hand raking. The cost of each rake complete is $320.

Engine-Driven Rotary Sweeper

A rotary sweeper was designed and built as an independently powered unit which can be attached to the department's standard snow-plow push frame by suspending it from the lifting unit.

The sweeper consists of a 6-ft brush, driven by a 22-hp, 4-cylinder air-cooled engine with a clutch reduction unit, through countershafts, sprockets and roller chain mounted as a unit on an angle-iron frame. The engine has ample power to maintain constant brush speed within a range of 70 to 140 rpm when used for heavy sweeping. Brush contact on the road surface is controlled by limit chains. The unit is fastened to the truck by the insertion of three connecting pins—1 for the lift, and 2 for attaching it to the snow-plow push frame. The cost of the complete unit is $850.

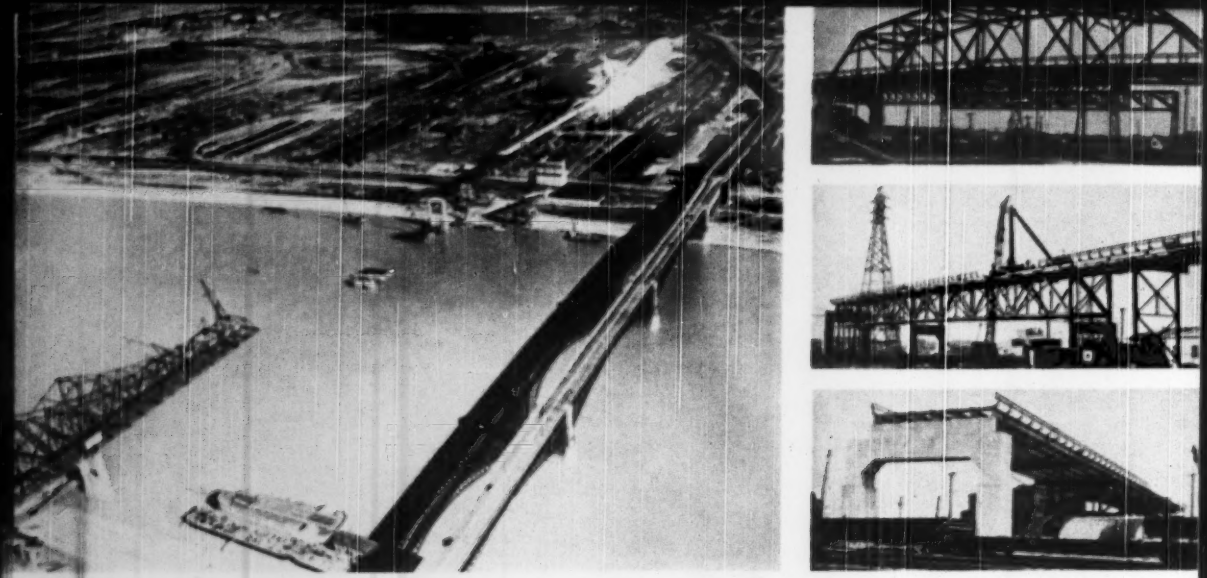
Pavement-Marking Machine

Three pavement-marking machines have also been constructed by the State Highway Department in the past 12 years. Since each successive machine has incorporated improvements, the latest model is believed to be the most efficient pavement-marking machine today in operation. It is so designed as to more than meet the standard marking scheme adopted by the Association of State Highway Officials.

The most recent model is mounted on a 1949, Model FC-304, GMC chassis fitted with a trailing third axle. The major units, in addition to the truck chassis, are two 60-cu ft air compressors and a 350-gal mixing and working tank built to ASME code for 100-lb working pressure with a built-in agitator to mix and keep the reflectorizing beads in suspension. As a means of communication between the driver and the spray-gun operator, who works from a seat in the rear of the unit, two US1 sound powered weatherproof headset transmitter telephones were installed. A special power-driven pump transfers paint from supply containers to the mixing tank on the truck.

In addition to the above-mentioned major units, numerous cams, valves, gages, strainers, paint and air lines, levers, warning lights, siren, and other miscellaneous items were used in its manufacture.

The machine is capable of spraying two continuous lines simultaneously; one broken and one solid line simultaneously; or a single solid or a single broken line at the rate of 12 mph. Construction cost was $11,280.33.



NEW FOUR-LANE vehicular bridge across Mississippi between East St. Louis, Ill., and St. Louis, Mo., parallel to Eads Bridge, is first new vehicular facility built across river between two municipalities in over 30 years. Because of increased length of tows, federal government required channel span of 964 ft, nearly double that of Eads Bridge. Problem of carrying approaches on East St. Louis side (background) across 26 or more railroad tracks was solved by using various types of construction, of which those shown above, at right, are typical. Note steel falsework under through truss.

$10,000,000 Toll Bridge Over Mississippi River Financed by East St. Louis, Ill.

CRAIG P. HAZELET, M. ASCE

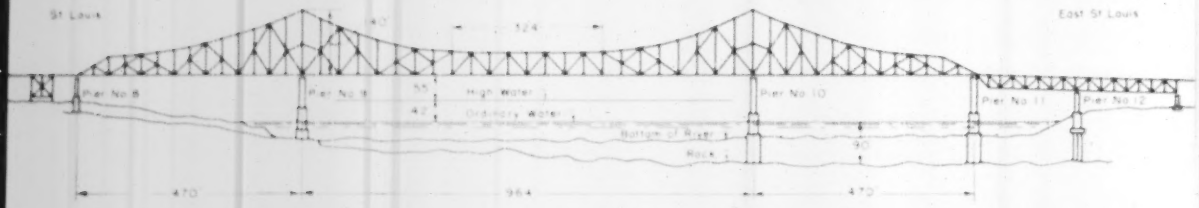
Hazelet and Erdal, Consulting Engineers, Chicago, Ill.

CAPTAIN EADS' famous bridge over the Mississippi River, which for seventy-five years has cast its graceful triple-arched silhouette on the broad waters of the Mississippi, is about to acquire a new neighbor. Less than 1,200 ft to the north, the citizens of East St. Louis, Ill., a city of less than 100,000 population, are rapidly pushing to completion a ten-million-dollar structure without levying additional taxes and without either state or federal grants. Existence of competing toll bridges made revenue bonds a convenient means of financing this bridge, the longest span over the Mississippi.

EVEN AFTER the construction of the Eads Bridge in 1874, and in spite of the fact that East St. Louis had been outstripped in size by its powerful rival across the river, this smaller community on the eastern bank of the river retained its hold on the freight terminal and warehouse business. Access to coal and oil in southern Illinois, coupled with an abundance of excellent industrial sites led subsequently to the establishment, on the East St. Louis side, of many of the largest industrial and manufacturing plants in that entire metropolitan area, now estimated to include more than 1,500,000 people.

Although there are five bridges in the East St. Louis St. Louis metropolitan area which carry vehicular traffic, only two will seriously compete with the new bridge. These are the Eads Bridge about a quarter of a mile downstream, and the McArthur Bridge, which is owned by the City of St. Louis and located approximately a mile south of the Eads Bridge. Both are toll bridges and the only

FIG. 1. SIMPLICITY OF DESIGN characterizes longest span over Mississippi River now under construction by small community of East St. Louis, Ill. Navigation requirements for long channel span, coupled with natural site conditions and inherent economy of cantilever type, led to choice of design adopted.



bridges whose approaches are within the corporate limits of East St. Louis.

No new vehicular facility has been built across the river connecting East St. Louis and St. Louis for over thirty years. Traffic studies have shown that both the Eads Bridge and the McArthur Bridge are, and for a considerable time past have been, carrying traffic greatly in excess of their normal capacities. Strange as it may seem, traffic studies showed that the McArthur Bridge was carrying traffic which in density per lane exceeded that carried by the George Washington Bridge and the Holland Tunnel at New York.

Project Financed by Revenue Bonds

Armed with these basic data, the City of East St. Louis, as early as 1934, started to explore the possibilities of financing a new structure on a toll revenue basis. After nearly 16 years of effort, numerous disappointments, several false starts and interruptions occasioned by World War II, the dream is about to be realized.

The project is worthy of comment not only because of the size of the financing program involved as compared with the small size of the sponsoring city, but likewise because certain physical features of the project go well beyond the average. The project is over 7,800 ft long. Navigation requirements set by the federal government call for a 964-ft channel span, nearly double that of the central arch of the Eads Bridge. In the 75 years which have elapsed since the construction of the Eads Bridge, paddle steamers and flatboats have been replaced by mass tows of a thousand or more feet in length. Bridge clearances have therefore of necessity been forced upward in the interest of safety for the bridges as well as for the carriers. Although other types of structures were studied, the span requirement of 964 ft, coupled with certain limitations imposed by the natural site conditions and economies inherent in the cantilever type, led to the adoption of this type for the main river spans.

The cantilever structure (Fig. 1) consists of two 470-ft anchor spans and two 320-ft cantilever spans, supporting a 324-ft suspended span. The total length of the main-river structure is approximately 1,904 ft. The cantilever span is the tenth longest in the world, and the sixth longest in the United States. It is the longest span over the Mississippi River.

A feature of the design of the bridge is its simplicity, purposely incorporated to economize on fabrication and facilitate erection.

In addition to the main-river span, there are two 213-ft deck-truss spans, two 120-ft deck-plate-girder spans, one 249-ft through truss span, and 2,432 ft of steel trestle. The remainder of the project is made up of 2,296 ft of hydraulic-fill embankment and approximately 155 ft of retaining-wall approach on the St. Louis side.

As may be seen from the aerial view, the alignment cuts directly across 26 or more railroad tracks be-

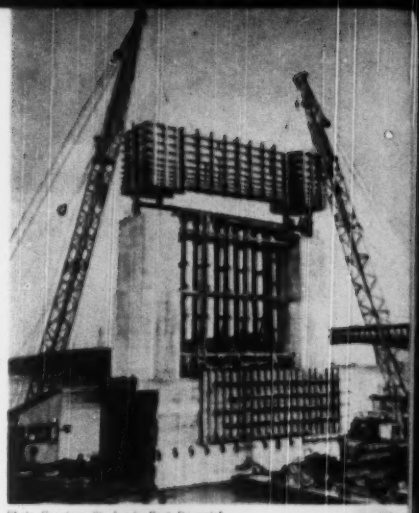
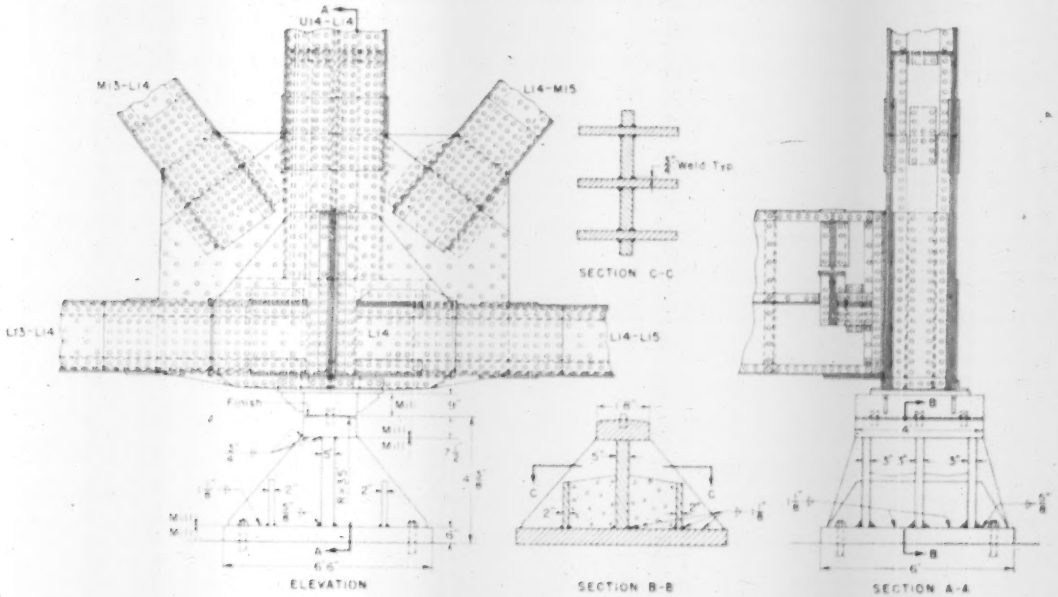
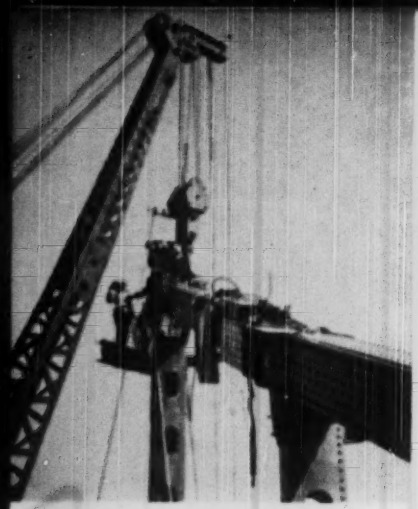


Photo Courtesy St. Louis Post-Dispatch

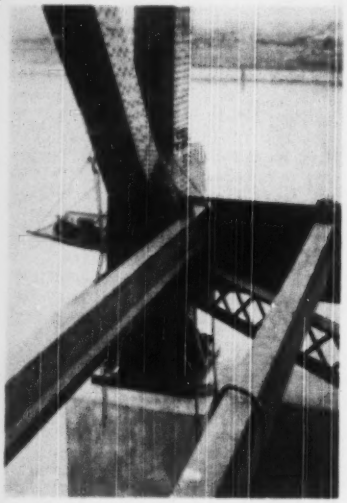
FORMS FOR TOP section of Pier 9 are set by two floating revolving cranes with 100-ft booms. During final pours, pier was over 85 ft above water. Pier foundation was constructed in dry inside of open cofferdam 39 X 84 ft. Like Piers 6, 7, 8, 10 and 11, it was founded on rock, as shown in Fig. 1.

FIG. 2. MAIN CANTILEVER SPANS of East St. Louis Bridge rest on rocker bearings on top of main piers. Flat bearing plate attached to bottom chord rests on curved upper surface of 4-ft bearing. See photograph of this rocker bearing on next page.





PIECE WEIGHING 20 tons (U13-U14) is set over Pier 9, west cantilever span (left). From this point, bridge was cantilevered 482 ft to center of channel. Rocker bearing for L14 (below), north truss on Pier 9, is of all-welded construction. Bearings are subjected to load of 4,840 kips under dead load plus full live load and impact. See Fig. 2. At L13, L14 and L15, main members and splice plates are being subjected to strain measurements in research project sponsored jointly by Purdue University, Northwestern University and Research Corporation. At L14, record is also being taken of rotation. Investigation has been made possible through cooperation of Bethlehem Steel Co., which has provided access to members.



Above Photos Courtesy L. E. Taylor

longing to five separate railroads serving East St. Louis and St. Louis. At first it appeared that the task of acquiring a satisfactory alignment and right-of-way through this maze of trackage might prove a formidable obstacle, but throughout the entire negotiations on easements, purchases, and agreements relative to relocation of tracks, each and every road gave the city the fullest cooperation. The following railroads were involved in the negotiations: Louisville & Nashville, Pennsylvania Railroad, Missouri Pacific, New York Central, and Terminal Railroad Association of St. Louis.

Had the Eads Bridge and the McArthur Bridge been free, it is obvious that the new structure could not have been financed by revenue bonds. Cities similarly situated should not prematurely press for the elimination of tolls on existing facilities without first determining whether or not it is likely that additional facilities will be required. Once a structure is toll free it is extremely difficult if not impossible to finance a new and perhaps badly needed facility by the issuance of revenue bonds. State and federal allocations of the motor fuel tax are rarely if ever used on projects of this character. As most cities are currently operating near the statutory limit for the issuance of general-obligation bonds, the revenue bond is a most convenient and frequently the only means of financing needed improvements.

Main Piers Rest on Rock

As indicated in Fig. 1, the rock line along the center line of the bridge varies from 40 ft above datum at Pier 8 to 94 ft below datum at Pier 12. The material overlying the rock varies in depth from a few feet at Pier 6 to 65 ft at Pier 11. It is a medium to coarse sand with traces of silt and some coarse gravel. The rock is a hard gray limestone. Piers 6, 7, 8, 9, 10, and 11 are all founded on rock. Pier 12 is supported on steel piles driven to refusal into the rock. Piers, abutments, and retaining wall west of Pier 6 on the St. Louis side are supported on steel piles driven to rock. All piers and abutments on the East St. Louis approach are supported on cast-in-place piles of 40-ton capacity.

Some conception of the task involved in the construction of the river piers can be gained from the fact that the total height of Piers 10 and 11 is approximately 190 ft—nearly the equivalent of a 20-story building. Pier 10 contains 7,740 cu yd and Pier 11 contains 5,375 cu yd of concrete.

The design generally is based on the 1944 edition of the AASHO Specifications for H20-44 loading modified by special design and construction provisions written for this project. The bridge provides four lanes of vehicular traffic. Silicon steel (ASTM-A94-46) was specified for the trusses of the main river spans. All other material is carbon steel (ASTM-A7-46). The roadway deck on this bridge, except for the cantilever spans and the suspended span, consists of a reinforced concrete slab with a nominal thickness of 7 in., resting on steel stringers spaced 6 ft 8 in. apart. On the cantilever span and the suspended span the deck consists of a $4^1/_2$-in. concrete-filled steel grid.

To minimize the secondary stresses in the floor-beam hangers on the main river spans, caused by deflection of the floor beams, the end connections of the floor beams were tapered $^3/_{16}$ in. in their depth (5 ft $0^1/_2$ in.) so that under dead load the angles will be vertical. The only exceptions were the floor beams at panel points L14, where the end-connection angles were placed at right angles to the beams and a support placed at the center of the beams to reduce deflection.

The pin-connected hangers at the expansion end of the suspended span, L22 east, are of silicon steel. The alloy steel pins are $6^1/_2$ in. in diameter. The maximum unit bearing stress is 16,000 psi. To reduce friction on these pins due to expansion and thereby reduce wear on the pin and secondary stresses in the hangers, bearing surfaces of pins and bores of truss members are to be lubricated by coating with Molykote, manufactured by the Alpha Corp., Greenwich, Conn.

Rocker bearings at L14 (Fig. 2), which are of all-welded construction, are subjected to a load of 4,840 kips under dead load plus full live load and impact. The net width available for line bearing between the flat bearing plate attached to the bottom chord and the curved upper surface (35-ft radius) of the bearing, after deducting for the diameter of the positioning dowels, is 40.4 in. The resulting line pressure is 119.8 kips per lin in. Permissible line pressure based on rolling tests by Prof. Wilbur M. Wilson, Hon. M. ASCE (Bulletin 191, Engineering Experiment Station, University of Illinois), is given by the formula,

$$P = (12{,}000 + 80D)\left(\frac{Y - 13{,}000}{23{,}000}\right)$$

where P is the design load; D, diameter of curved surface in inches; and Y, yield point of the material. In this case, $D = 840$ in. In the design, the yield point was assumed to be 45 kips psi. On this basis, P was found to be 110.0 kips per lin in. The critical load as found by Professor Wilson, based on the same

yield tests, is 50 percent greater than the permissible load in accordance with the above formula. The critical load for the bearing as designed is about 165 kips per lin in.

The material used for the two plates in contact is Mayari steel—ASTM, A 242 modified. Tests of the material actually used gave the following results:

Yield point	54,000 to 56,000 psi
Tensile strength	79,000 to 81,000 psi
Elongation in 2 in.	34 percent
Reduction of area	57 to 60 percent

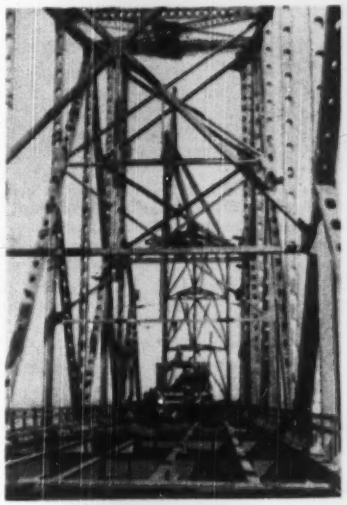
In accordance with Hertz's formula, the width of the contact area is $0.0004 \sqrt{P \times D}$ = approximately 4 in. On this basis, the average unit pressure is about 30,000 psi, and the maximum pressure is $1.27 \times 30{,}000$ or 38,000 psi. The joints in the plates forming the transverse web and the longitudinal stiffeners were arranged to reduce the shear on the welding to a minimum, the load being carried by direct bearing of the material on the lower face of the upper plate. In the preliminary design, $1^1/_4$-in. maximum eccentricity of the contact point, due to rotation, was assumed. Later the calculated maximum eccentricity due to rotation was found to be approximately 1 in.

The design of the main compression members was based on the provisions of AREA Bulletin 467, 1947, "Rational Design of Sections for Short Compression Members of Steel," by L. T. Wyly.

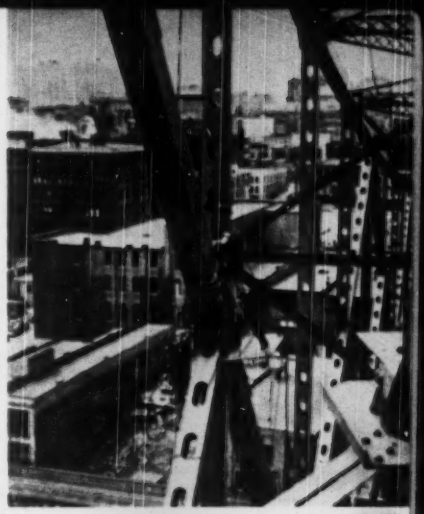
Pier 9 was constructed in the dry inside of an open cofferdam 39 × 84 ft. Five tiers of steel wales and bracing were used, the sets being suspended from timber falsework and lowered by six sets of blocks. The steel sheetpiles were set with an American Revolver floating crane equipped with a 100-ft boom and then driven 25 ft to bedrock with a No. 7 McKiernan-Terry hammer. The sloping surface of the rock at this location necessitated considerable drilling and blasting to step and key the pier properly to the foundation.

Placement of Pier Concrete

Timber ramps built out from the shore enabled the ready-mix concrete forming the lower section of the pier to be placed direct from the agitator trucks by means of chutes and "elephant trunks." As the pier increased in height, this system was superseded by a bucket-passing procedure, utilizing two floating revolving cranes equipped with 100-ft booms and moored adjacent to each other. The crane nearest the bank picked up a freshly filled $5^1/_2$-cu yd bucket of concrete on the levee and relayed it to an adjacent barge. Here it was picked up by the second crane and passed to the top of the pier, which during the final pours was over 85 ft above water.



RIVETING GANG (right) works on M11, downstream truss, on anchor span at St. Louis end of bridge. Riveted splices of main compression members are proportioned to carry at least 50 percent of design load. Maximum out-of-plane of end of member milled for bearing was specified as one-half of 1 min of arc. Erection procedure, looking east from L6, is seen under way, below. Depth of chords of anchor spans and cantilever spans is $26^1/_2$ in. On main members, cover plates with perforations 10 × 20 in. and 12 × 20 in. were used in place of lacings. Edges of perforations in silicon steel were machine flame cut, then edges were immediately softened by automatic annealing torch.



Piers 10 and 11 were sunk by open dredging through openings in the caissons. When within about 2 ft of the rock surface, air locks for men and material were installed in each dredge well and the caisson sunk to rock. Pier 11 was constructed in advance of Pier 10. In Pier 11 the contractor used twin cylindrical caissons 30 ft in diameter for the bottom 22 ft, belling in to 25 ft for the top 76 ft. The lower sections were built in a nearby shipyard, towed to the site, and docked by means of four pile dolphins. Three of these clumps were required for each caisson and were equipped with hand winches for controlling the position of the caissons.

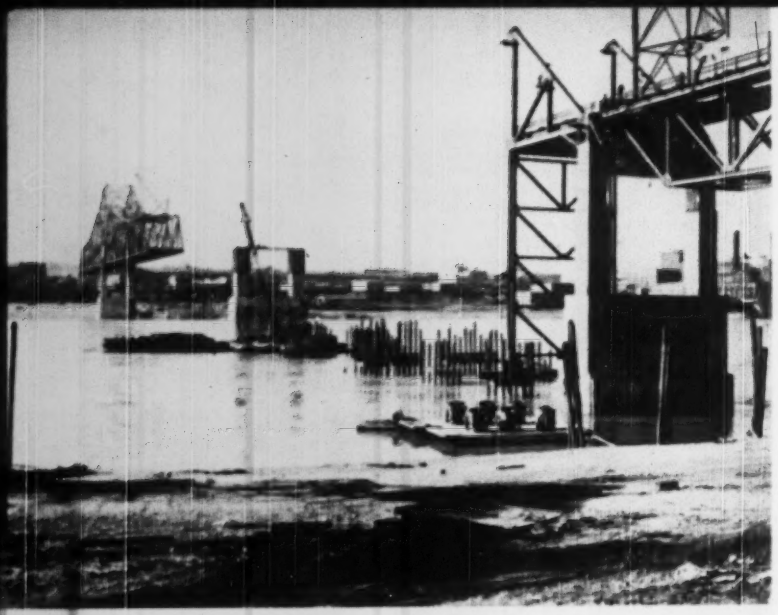
A 13-pile dolphin upstream, equipped with a gasoline hoist, was used to pull and hold the caisson against the current. Whirler rigs equipped with $1^1/_4$-cu yd clamshell baskets were used during dredging.

Pneumatic equipment included four 500-cfm compressors. Air from the compressors passed into a main, thence through a water-jacket aftercooler and into a storage receiver at 110-lb pressure. From the receiver, the air was supplied to the working chambers at the required pressure, regulated by three Fisher reducing valves. The maximum pressure required on Pier 11 was 48 psi. A single caisson was used for Pier 10, the first section of which was 30 × 76 ft and 16 ft high. It was towed to the site and docked in four three-pile dolphins. Dredging and pressurizing operations were similar to those described for Pier 11 except that six 500-cfm compressors were required for this larger caisson. The pneumatic caisson work on Pier 10 was performed at a maximum pressure of 40 psi.

Concreting operations for both Piers 10 and 11 were conducted from loading docks on the bank of the river. Concrete from the agitator trucks was discharged into a hopper, thence into concrete buckets resting on pontoons, and then was ferried to the pier, where it was handled by whirler cranes and deposited directly in the forms. On Pier 11, which is close to the east bank of the river, the concrete was handled by a whirler crane direct from the river bank to the forms.

Erected by 92-Ton Traveler

Erection of the superstructure was started at Spans 7 and 8. Here a "supply derrick" was mounted and used to erect the first bent of falsework, the first two panels of the anchor arm, and the 92-ton traveler, which was equipped with a 100-ft boom and a 5-ft 8-in. jib. The hoist



AFTER ABOUT 17 MONTHS OF WORK, St. Louis anchor and cantilever spans and half of 324-ft suspended span are in place (far left), river pier No. 10 (center) is nearly completed, and erection of east anchor span is about to begin (right foreground). Since east anchor span is entirely over water, falsework must be supported on steel-pile bents, here seen in place. Same erection equipment and procedure will be used as on west half of structure.

was powered through a fluid drive clutch which gave very smooth control. Four bents of falsework were used in erecting the 470-ft anchor span. These were placed at L2, L4, L6 and L10. The falsework consisted of steel columns and bracing resting on grillages, which in turn were supported on wedge jacks over the footings. The use of wedge jacks has facilitated holding all steel to proper line and grade as erection proceeds.

After the erection was completed to L14 at Pier 9, the bridge was cantilevered to the center of the channel, a distance of 482 ft. The traveler was then dismantled and moved to the east side of the river preparatory to starting erection of the east half of the river structure.

The long approaches on the east side consist of multiple-rolled beam spans, also two 213-ft deck truss spans and one 249-ft through truss span. The steel bents supporting the rolled beam span were assembled on the ground and erected as a unit by a 60-ton speed crane with a 100-ft boom. The 213-ft deck trusses were assembled on the ground in half-truss lengths and erected on a single falsework bent located at mid-span. The 249-ft through truss spanned several main-line tracks, which had to be kept clear for the passage of trains. Here heavy steel falsework trusses supported on steel bents were used and the trusses erected in the usual manner.

Research Project Measures Stresses

In the belief that the construction of a structure of this magnitude offers an excellent opportunity to obtain valuable information as to the actual stress distributions in large truss members, stress measurements at selected points are being made as erection proceeds. This research is sponsored jointly by Purdue University, Northwestern University and the Research Corporation. The principal points under investigation are in the main members and splice plates at L13, L14, and L15.

The research project was initiated by Prof. L. T. Wyly, M. ASCE, of Purdue University. The work is being carried out by Professor Wyly and R. W. Kluge, Assoc. M. ASCE, of Purdue, and Prof. M. B. Lagaard, M. ASCE, of Northwestern University, assisted in the field by N. J. Law, Resident Engineer for Hazelet & Erdal, R. C. Fiebrantz, Resident Engineer for Bethlehem Steel Co., and Messrs. Ed. Larsen, K. H. Lenzen, Jun. ASCE, and L. B. McCammon, Jun. ASCE. The generous cooperation of the Bethlehem Steel Co. has made this investigation possible. The company has permitted access to the members in the shop and furnished walkways and platforms for the use of observers in the field. A subcommittee of the ASCE Structural Division has been set up to advise regarding the work and to review the final report.

Engineering and Contracting Organization

The project was initiated in 1929 jointly by the late George A. Maney, M. ASCE, and Joseph B. McGlynn, Corporation Counsel of the City of East St. Louis. In 1935 Mr. Maney was retained by the city as consulting engineer for the project and with Professor Wyly as principal associate, made the layouts, preliminary designs and estimates upon which the promotion was based. Because of difficulties in financing and delays occasioned by the war, the project was postponed nearly 10 years. In 1947 it was revived. When, through ill health, Mr. Maney was forced to retire from active participation in the project, final studies were undertaken by the firm of Hazelet & Erdal, Consulting Engineers, with the late Charles A. Ellis, M. ASCE, Professor Wyly, and Hymen Shifrin, M. ASCE, as associate consultants. This group, comprising George A. Maney & Associates, has been in charge of the preparation of final plans and specifications as well as of supervision of construction. N. J. Law, a member of the staff of Hazelet & Erdal, has been resident engineer during construction.

Traffic studies were made by the firm of Parsons, Brinckerhoff, Hall & Macdonald. The general construction contract is held by William J. Howard, Inc., of Chicago. Subcontractors are:

SUPERSTRUCTURE	
Furnishing and erecting main river spans	Bethlehem Steel Co.
Fabrication of approach spans	Stupp Bros. - Allied Steel
Floor slabs	Robinson Erection Co.
Erection of Approaches	John F. Beasley Construction Co.
FOUNDATIONS	
Main river piers	Massman Construction Co. - Kansas City Bridge Co.
Foundation on approaches	Robinson Erection Co.
Hydraulic fill	LaCrosse Dredging Co.

The City of East St. Louis, which is the sole sponsor of the project, has been represented through its regular City Commission which, since the project was revived in 1947, has been composed of John T. Connors, Mayor; Alvin G. Fields; John T. English; Russell T. Beebe; Joseph W. Ganschinietz; David D. Johnston, City Engineer; Joseph B. McGlynn, Special Counsel; T. E. Krebs, City Treasurer; and John Tierney, City Clerk.

Is the Practice of Engineering a Profession or a Business?

DONALD M. BAKER, M. ASCE
Partner, Ruscardon Engineers, Los Angeles, Calif.

THE QUESTION, "Is the practice of engineering a profession or a business?" would have had little pertinency during the latter part of the Nineteenth Century. In the past fifty years, however, great changes have occurred, not alone in the amount and character of technical knowledge, but in the manner in which the practice of engineering is carried on, and in the structure and manner of functioning of groups or firms engaged in it.

Engineer Sells His Specialized Knowledge

Engineers are in the habit of calling themselves professional men, irrespective of the functions they perform, or the manner in which they perform them. In the sense in which the term "profession" was developed, and in the minds of the general public, a profession is a calling or means of livelihood, the pursuit of which involves the utilization of specialized knowledge, and the ability to exercise independent judgment based on this knowledge. A business, on the other hand, is a means of livelihood in which things, including services and commodities, are bought, sold, produced, or handled.

Today, the professional man sells his specialized knowledge and judgment, while the business man sells a product which is the result of his knowledge and judgment. The professional man must operate in what is essentially a non-competitive market, since he may not advertise or compete with others in his profession on a price basis. A business man, on the other hand, operates in a competitive market and must, if he is to survive, do all the self-advertising things which the professional man is prohibited from doing.

Changes in Practice of Engineering

A century ago, it was customary to speak of the three "learned" professions—medicine, law and theology—entrance into which required a thorough grounding in fundamental principles, usually secured through formal training. As science and its applications developed, formal education was provided for other vocations, including engineering, architecture, accounting, dentistry, etc., and a man who followed such a calling was termed a "professional man."

By the turn of the century, the manner in which the practice of engineering was carried on commenced to change. Engineers began to function differently from those who followed the other "professions." Structures, projects, machines and facilities were becoming larger and more complicated, and large organizations were required to plan, design and supervise their construction or manufacture.

Engineering firms with large staffs came into being, and private and public agencies set up engineering organizations whose staffs functioned as a team. The team was composed of a considerable number of men who were little more than skilled mechanics, a smaller number who performed more or less routine operations, and a few who had a substantial amount of technical knowledge and judgment, but whose duties for the most part became more and more administrative as the top of the organization was approached.

The engineering organization, whether public or private, commenced to function as a business organization. Seldom was any member of such an organization called upon to render a personal opinion based on his own individual judgment, experience or effort. The organization assumed responsibility for its product, which was essentially a service, but in the same manner as would a business or industrial concern.

While private engineering firms and companies are prohibited from advertising their product—engineering services—by the codes of ethics of the various engineering societies, and are likewise prohibited from competing with others on a price basis, in practically all other respects they function as does a business concern.

Moreover, commencing 40 or 50 years ago, educators began to realize the need of formal preparation for the general field of business and industry. Courses in Commerce and Business Administration commenced to be offered in college curricula. Just as the courses in engineering were based on science and mathematics, so the courses in commerce and business administration were based on economics and finance.

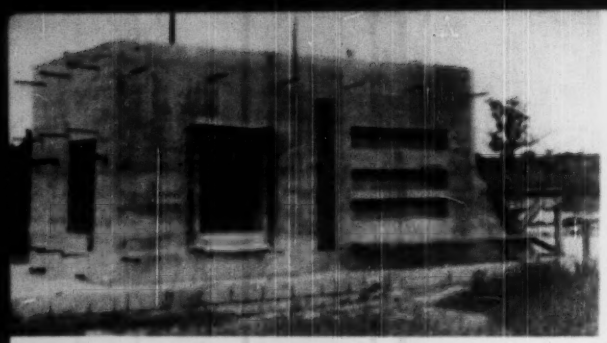
Is the Banker a Professional Man?

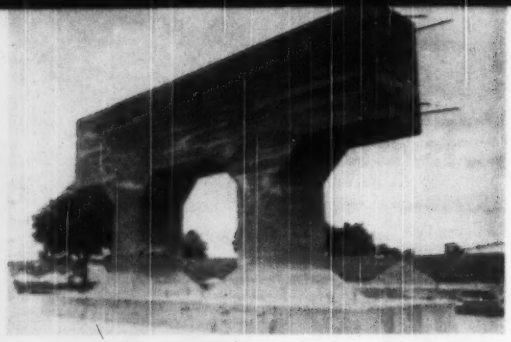
The question arises as to whether the head of an engineering firm, the city engineer of a large municipality or the chief engineer of a large industrial concern, functions differently from the head of a fair sized bank, who has completed a course in business administration, majoring in banking and finance, and acquired further knowledge and judgment through experience. If the engineer is considered to be a professional man, it would seem that the banker, the insurance executive, the head of a manufacturing concern, or any other person with comparable education and experience in the field of business or industry should likewise be called professional.

On the other hand, the head of an engineering organization, like the president of a bank, does not function in the same way as do doctors, lawyers, accountants or those in such more recently developed fields as public relations counseling and advertising counseling. The consulting engineer, however, does so function, since he renders services essentially of a personal character.

Definition of "Professional" Requires Thought

It would seem that a choice must be made. If the difference between a profession and a business is considered to consist in the amount of formal education, knowledge and experience which the practitioner must have, then any calling that requires such specialized knowledge and preparation, even though essentially in the field of administration, is a profession. On the other hand, if the distinction between a business and a profession lies in the manner in which the practitioner functions, the degree of personal service which he renders, and the personal responsibility which he accepts, then neither the head of an engineering concern, nor even his top employees can be considered professional men—no more than can executives in the banking, insurance or industrial fields. This is an age of specialized knowledge, and some serious thinking on this subject is indicated.





COMPLETION OF TEST BLOCK and bridge pier of Prepakt concrete at Waterways Experiment Station, Jackson, Miss., marks first stage of investigation on value on this type of concrete for massive structures. Test block (above, left) about 10 ft high (85 cu yd) contains simulated gallery and penstock or sluice. On near side note copper water stop around gallery entrance and horizontal and vertical blockouts. Bridge pier (above, right) containing 15 cu yd has height of about 9 ft above 1-ft-thick conventional reinforced concrete footing.

Two Test Structures of Prepakt Concrete Completed at Vicksburg Experiment Station

HERBERT K. COOK

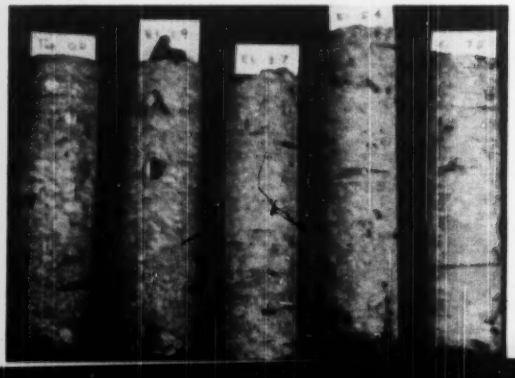
Chief, Concrete Research Division, Waterways Experiment Station, Corps of Engineers, U.S. Army, Jackson, Miss.

PREPAKT CONCRETE, originally developed as a bonding and non-shrinking material for use in rebuilding disintegrated concrete areas, has been proposed for new construction of massive dams. The Waterways Experiment Station has undertaken the investigation here described to determine the suitability of this type of concrete for mass construction, and to obtain first-hand knowledge of some of the engineering and construction problems likely to be encountered in such work. The manufacture of Prepakt concrete requires the use of materials and methods patented by the Prepakt Concrete Co., Cleveland, Ohio. The Corps of Engineers has been licensed to use it on civil works construction.

AS FAR AS is known, no full size structure has so far been constructed of Prepakt concrete, which is made by packing the forms with coarse aggregate and then pumping in a cement-base intrusion mixture or grout to fill the voids. The coarse aggregate for small or heavily reinforced structures should be graded from $^3/_8$ in. to 3 in. or less as in the present investigation. In massive construction the aggregate may be graded from $^3/_4$ to 6 in. The intrusion mixture or grout is composed of portland cement, sand, water, Alfesil (filler), and Intrusion Aid. The Alfesil, a patented product, is a finely divided siliceous material having a specific surface about twice that of normal portland cement, consisting largely of spherical particles, and having the property of combining with calcium hydroxide to contribute watertightness and long-continued gain in strength. The Intrusion Aid, also a patented product, prevents early stiffening of the grout, reduces the water requirement for a given consistency, prevents the agglomeration of cement particles, tends to hold the solids in suspension, and produces a grout which expands slightly before final setting.

The question of optimum grading of sand for use in the intrusion grout mixture was investigated in a previous study by the Waterways Experiment Station. Using a sand with an original fineness modulus of 3.28, five gradings were prepared: (1) Scalped over No. 8, F.M. 2.67; (2) scalped over No. 16, F.M. 2.38; (3) scalped over No. 30, F.M. 1.77; (4) regraded, 100 percent finer than No. 16, F.M. 1.35; (5) regraded, 4.6 percent retained on No. 16, F.M. 1.70. Only sands in the last two categories were found satisfactory, the reason being of course that there must be a sizable gap between the smallest coarse aggregate size and the largest fine aggregate size to prevent plugging.

Engineering and construction problems likely to be encountered in building massive structures of Prepakt concrete include the following:



DIAMOND drill (far left) takes core through pier cap, column and footing. Core from east column, 9.3 ft long, appears at left. Distribution of coarse aggregate and voids, contact surfaces, segregation, entrained air, and gas bubbles will be studied.

TEST BLOCK FORM was completely filled with grout (right), and 2 × 6 wood template was installed for 18-ft stainless steel gage used to measure volume change. Wood plug at right, center, is in grout sampling well. Top surface of block was not struck off, tamped, screeded, or troweled.

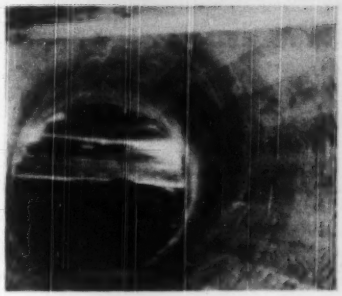
1. Effect of variation in aggregate grading
2. Effect of aggregate segregation
3. Placement difficulties as compared with ordinary concrete
4. Methods of determining proper consistency and quality of concrete
5. Suitable means of determining compliance with specifications
6. Suitable means of embedding items such as penstocks, sluices, reinforcement, and gate guides
7. Elimination of spalls and dirt which might collect at the bottom of each lift of coarse aggregate
8. Cost of securing coarse and fine aggregates of proper grading
9. Additional operations necessary to insure coarse aggregate of adequate cleanness and freedom from coatings
10. Use of special ingredients, Alfesil and Intrusion Aid
11. Applicability of present mixture design investigations to design of Prepakt concrete
12. Flow of grout around formed surfaces
13. Flow of grout around, bond to, and displacement of embedded items
14. Quality of bond to precast slabs, foundation rock, and footings

The tests have not progressed sufficiently to date to provide final answers to these questions.

The investigation involved the construction of a test block and bridge pier of Prepakt concrete. These models contain several types of embedded items analogous to those found in mass concrete dams, and the construction procedures used were designed to simulate, as far as possible, those that would be used in the field. The following prototype features were simulated:

Penstock, sluice. An inclined 24-in.-dia wood-stave pipe was constructed in the test block of 1 × 4-in. flooring with edges beveled and inserted in the test block as a form. The two end and two intermediate bulkheads were constructed so that the entire pipe form could be removed for inspection of the pipe. The pipe form was held by falsework and braced. After 14 days the pipe form was removed and the pipe packed with coarse aggregate and grouted for the purpose of checking the bond of Prepakt concrete to Prepakt concrete.

Gallery. The rectangular gallery



SURFACE OF Prepakt concrete inside simulated penstock (above), looking down into gallery, shows pattern of wood-stave form, removed after 14 days.

in the test block is 3 × 4 ft high, with a 90-deg turn and an 8×8-in. gutter. The wood forms were so constructed that they could be removed for concrete inspection after curing.

Reinforcement. Reinforcing bars were placed in the bridge pier and around the gallery in the test block and their precise location determined and recorded so that any displacement can be determined. Bars were cleaned to remove loose rust, oil or any other coating that might interfere with bond, and secured to avoid displacement.

Blockouts. Wood forms for horizontal and vertical blockouts 12 in. wide and 8 in. deep were fastened to the side form of the test block. Blockouts had venting forms at lower surface to permit escape of air and water and allow grout to fill corners of form completely.

Water Stop. A copper stop was installed around the entrance to the short leg of the gallery in test block.

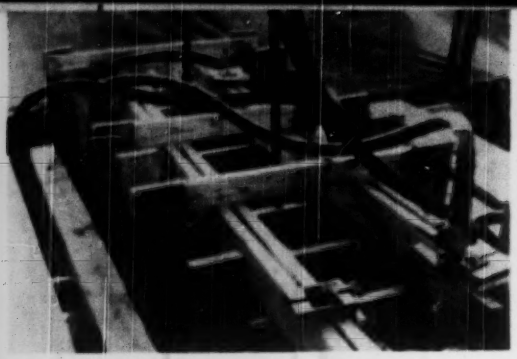
Foundation Bond. For study of bond between Prepakt concrete and foundation rock, a limestone slab about 3 ft in diameter was placed on bottom of test-block form and its surface cleaned and sand blasted. It was so located that cores could be cut through the test block into the slab without interfering with embedded items.

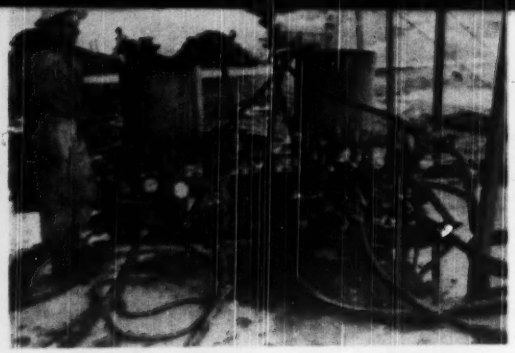
Precast Slab Forms. Twelve slabs of conventional reinforced concrete were manufactured in advance to form one end of test block. Each slab contained a single layer of 6-in.

COARSE AGGREGATE was placed in test-block form (above) in thin horizontal layers over full area to avoid displacement of any item, segregation, and excessive breakage. Note 12 precast reinforced concrete slabs used as form for near end of block and firmly fastened by rods through 1-in.-dia hole in center of each slab.

MACHINE batches, mixes and pumps grout for test block at left. Duplex pump is behind kneeling operator. Grouting equipment was provided by Prepakt Concrete Co. It was required that intrusion pump be supplied with grout at 5 cu yd per hour and have grouting capacity of 15 cu yd per hour. This rate should not be compared with that to be used on full-scale project.

wire mesh (1/4-in. diameter) midway between top and bottom surfaces and had 1-in. diameter hole at center and U-bar embedded at each corner for handling. Six of the slab surfaces to be bonded to Prepakt concrete were roughened by sand blasting; remainder of slabs were untreated. In lower two rows each slab was held in place by 1-in.-dia rod grouted through foundation slab within test block and extending upward toward sloping slab at 45-deg angle, passing through center hole in slab at right angles and extending 8 in. beyond its





BRIDGE PIER FORM (above, left) has mortar-tight cap cover through which vertical pipes carry grout. Cap cover was designed as venting form to withstand grout pressure of 20 psi. Intrusion of grout began at lowest point in columns, and pipes were withdrawn as grouting proceeded. Grout for bridge pier was pumped by triplex pumps (above, right) supplied with grout by same batching, mixing and pumping plant used for test block.

outer face. In upper two rows each slab was held in place by a 1-in. tie-rod extending to opposite face of test block. The joint opening of $\frac{3}{16}$ in., which was left between adjacent slabs, was filled with cement grout.

Bridge Pier Footing. A 1-ft thick conventional concrete footing containing reinforcement was constructed for the bridge pier.

Horizontal Joints. Test block was grouted in three stages with 2-hour delay before second stage and 12-hour delay before final stage.

Monolithic Joints. Change of length of test block was measured.

The models were constructed at the Jackson, Miss., Sub-Office of the Waterways Experiment Station, Corps of Engineers, U.S. Army. Existing concrete floor slabs from demolished temporary buildings were used as foundation slabs. Forms were of wood. Anchors and tie rods consisted of 1-in.-dia round steel bars, grouted through the foundation slabs. All forms were essentially mortar-tight and were given a thin coating of a non-staining light mineral oil just before coarse aggregate was placed.

Coarse aggregate consists of crushed gneissic granite from North Carolina. It was obtained in two size ranges, graded up to 3 in. for the test block and up to 2 in. for the bridge pier. In each case it was required that 5 to 15 percent pass a $\frac{3}{4}$-in. sieve and that 0 to 5 percent pass a $\frac{3}{8}$-in. sieve. The larger coarse aggregate was placed in the test-block form except in areas adjacent to embedded items, where space was limited. In such areas and in the bridge pier form the smaller aggregate was used.

The slotted grout pipes were placed by the Prepakt Concrete Co. The grout pipes for the test block were placed horizontally parallel to the long axis of the block and consist of 2-in. pipes with 6-in. slots on 3-ft centers. Two pipes were located near the base of the form, one 3 ft from the side under the gallery, the other 2 ft from the opposite side. Three additional grout pipes were located at quarter points 5 ft from the base of the form. Pipes extend through the wood form but not through the precast slab form on one end. A resistance thermometer and a thermocouple were placed at each of two locations, one at the center of the test block, the other at a quarter point. An additional thermocouple was placed near the bottom of the form. The lead wires were brought through separate holes in the side form and were labeled.

Grout mixtures for the test block and the bridge pier were designed by the Prepakt Concrete Co. to give a 90-day compressive strength of 2,500 psi in the block and of 5,000 psi in the pier. The grading of the sand was not ideal in that a considerably larger quantity of material passed the 200-mesh sieve than was desirable.

The test block was grouted in three stages on April 12 and 13, 1949. It was intended that the grout level be maintained essentially horizontal and be raised during each stage of pumping at the rate of approximately 1 ft per hour. Stage 1 grouting, the lower $2\frac{1}{2}$ ft, began on the morning of April 12 using uncolored grout pumped through the two grout pipes near the bottom of the test-block form. Stage 2 grouting, between El. 2.5 and 5.0 ft, began on the same afternoon after an interval of 2 hours had elapsed after completion of Stage 1. The grout for this stage was colored red and was pumped through the same pipes used for Stage 1. Stage 3, the upper 5 ft of the test block, was grouted from the upper grout pipes, using uncolored grout, beginning the next morning, after an interval of about 12 hours had elapsed after completion of Stage 2.

The bridge pier was grouted with vertical grout pipes on the afternoon of April 13 in one stage in approximately $2\frac{1}{2}$ hours. Concrete in both models was cured for 14 days. The formed gallery and pipe in the test block were kept closed during the curing period to prevent circulation of air. The wood forms were kept continuously wet until removed and the top surface of the block was kept covered with a 1-in. maximum thickness of sand for the entire curing period. A membrane-forming curing compound was applied to the exposed front and left side of the test block upon removal of forms. No forms were removed until 14 days had elapsed, except those on the front and left side of the test block, which were removed at 3 days.

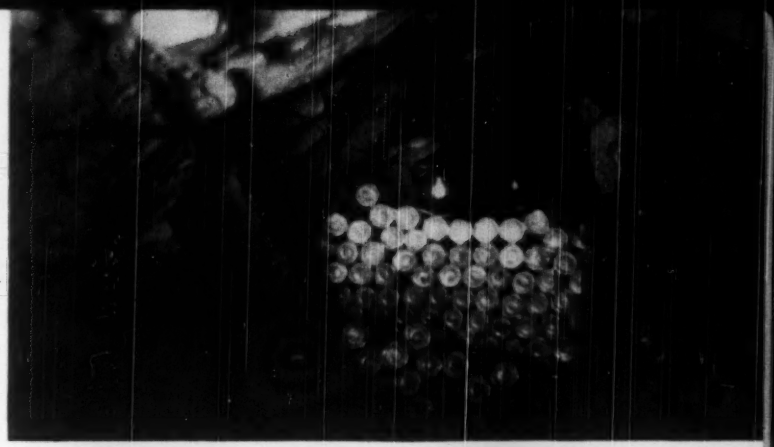
After removal of forms from the penstock, a detailed inspection of the interior surface was made. The pipe was then packed with coarse aggregate graded up to 3 in. in size and on May 3, 1949, was grouted with a mortar similar to that used in the rest of the test block.

Core drilling operations were begun when the concrete reached the 28-day age and involved the recovery of about 125 ft of 10-in.-dia core by diamond drilling. About 12 ft of core has also been drilled horizontally.

The two 36-in.-long horizontal cores taken through the precast slabs in the test block were sawed into 6 × 6 × 30-in. beams for test for flexural strength by third-point loading. The beams were immersed in water for 24 hours before testing.

Four of the vertical cores from the test block and all the cores from the bridge pier were cut to 20-in. lengths for compressive strength tests. These specimens were divided into two comparable groups, one tested at 60 days and the other at 90 days.

Four of the vertical cores from the test block were cut into 16-in. lengths and tested for resistance to freezing and thawing. The sections from two cores were tested in the accelerated laboratory freezing and thawing test. The sections from the other two cores were installed on the exposure rack at Treat Island, Me., in the fall of 1949.



EXPLOSIVE CHARGE for record 1.3-million-lb blast is loaded into section of nearly one mile of tunnels which honeycomb blast site. Sandstone formation characterized by cross jointing proves ideal for coyote tunnel method of blasting. Two lines of Primacord (foreground) run through each charge and are attached to special primers needed to detonate Nitramon, explosive used throughout blast.

Record Blast Provides 1.8 Million Cu Yd of Rock for South Holston Dam

GEORGE K. LEONARD, M. ASCE
Chief Construction Engineer, TVA, Knoxville, Tenn.

EXISTING BLASTING RECORDS were shattered when TVA engineers began to quarry over 3 million cu yd of rock fill for South Holston Dam, sister structure to Watauga Dam (see CIVIL ENGINEERING, May 1948). An ideal location for the quarry site enabled the rock for the dam to be placed at a total cost of 97 cents per cu yd. Quarrying procedure and cost breakdown are reviewed in Mr. Leonard's article.

THREE BLASTS, each one of which exceeded any previously fired for construction or quarry purposes, provided practically all the 3,390,000 cu yd of quarry-run rock for South Holston Dam. One blast alone yielded 1,800,000 cu yd. The quarrying was done by the coyote tunnel method, a system of almost horizontal tunnels on one or more levels throughout which the explosive is placed. The amount of explosive was ascertained from the volume of rock above the charge, the ratio of explosive to rock varying from about 1 lb of explosive per cu yd of rock over the outside tunnels to about 2 lb over the inside tunnels.

South Holston Dam is a multiple-purpose project, having as its functions flood control and power. In addition to the quarry-run rock mentioned, it will contain 420,000 cu yd in the filter blankets, and 2,090,000 cu yd of earth fill.

Studies showed that the earth- and rock-fill type of structure was the most suitable both economically and for the existing site conditions. The dam will stand 285 ft high and have a crest length of 1,550 ft, a top width of 32 ft and a maximum base width of 1,170 ft.

The principal features of the project in addition to the dam are a morning-glory spillway with a combined diversion, spillway, and sluiceway tunnel, a short (1,200-ft) power tunnel 15 ft in diameter, a powerhouse containing one 35,000-kw remotely controlled generator, an auxiliary spillway, and an earth-fill saddle dam. (See Fig. 1.) The spillway has a circular crest of 128-ft diameter tapering to 34 ft in the vertical shaft and in the horizontal tunnel. Six deflectors built around the crest produce a uniform flow and eliminate surges and pulsations. The horizontal leg of the tunnel, serving as a diversion tunnel during construction, will be plugged after completion of construction and two Howell-Bunger valves will be installed in the plug to control discharge. Upstream from each valve a slide gate will be installed for emergency service. Access to the tunnel and operating mechanism of the valves and gates will be through a control tower.

To improve flow conditions in the tunnel, an energy dissipater will be built just downstream from the valves, and a combination weir and guide structure will be constructed at the intersection of the diversion and spillway tunnels. Additional discharge capacity will be provided by an overflow weir built in the reservoir rim, which will empty into the river nearly three miles below the main dam. The earth-fill saddle dam built at one point in the rim of the reservoir will be 3,400 ft long and about 40 ft in maximum height. The saddle dam is underlaid with a typical limestone foundation, and extensive treatment will be necessary along the cutoff.

At the beginning of the flood season, on January 1, the reservoir will be drawn down so as to provide 300,000 acre-ft of storage. At all times there will be a minimum reservation

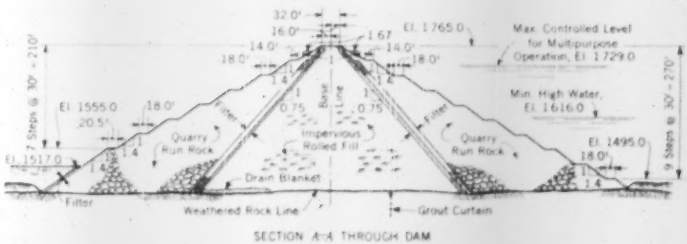
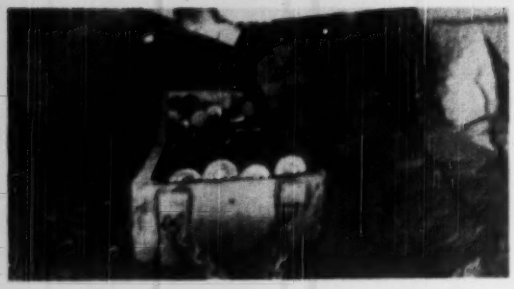


FIG. 1. SOUTH HOLSTON DAM, combination earth- and rock-fill structure, will be 285 ft high and have crest length of 1,550 ft. Structure contains 3,390,000 cu yd of quarry-run rock, 420,000 cu yd of crushed rock, and 2,090,000 cu yd of earth fill.

SECTION A-A THROUGH DAM



POWDER MEN pass explosive into one of cross-cuts. Sled (foreground) was used to pull explosive along adits to tunnel system. No explosive was placed in adits.

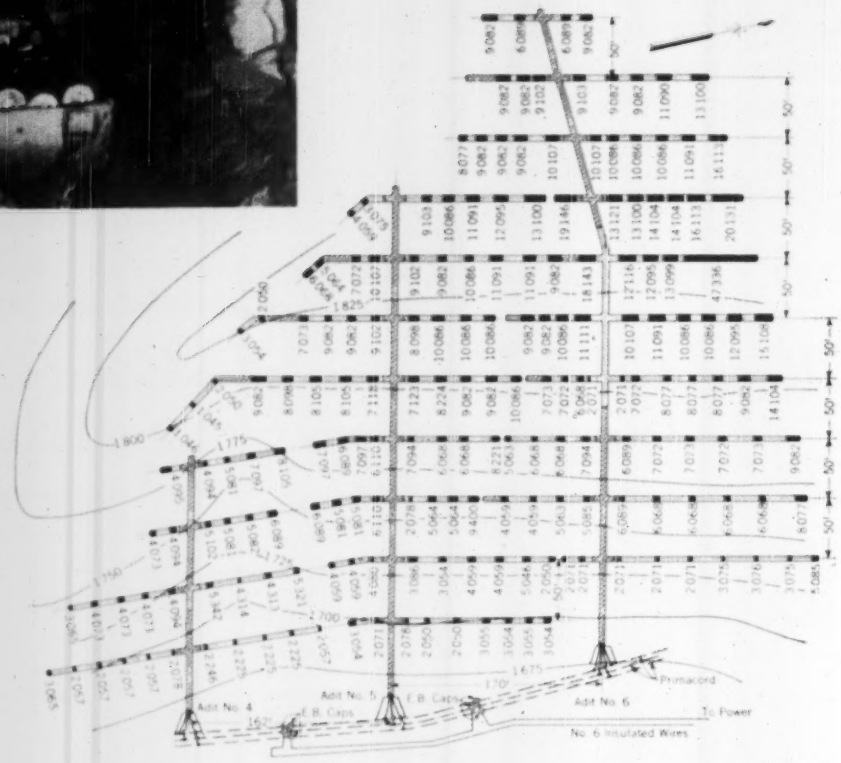


FIG. 2 (RIGHT). BLAST NO. 2, largest of record, loosed 1,800,000 cu yd of rock with 1,362,985 lb of explosive, distributed as shown in layout. Figures indicate charges, in pounds. Cross hatching indicates sand stemming used in adits to get full effect of blast where it was wanted. Ratio of explosive charge to rock varied from 1 lb of explosive per cu yd of rock for outside tunnels to 2 lb for interior tunnels.

for flood storage of 110,000 acre-ft. Although there is evidence of a maximum flood at the dam site of only 45,000 cfs, the reservoir is designed to safely handle a flood of 133,000 cfs. During a flood of this kind, the reservoir will discharge at the rate of 71,000 cfs, of which 39,000 cfs will be discharged through the morning-glory spillway, 11,000 cfs through the sluices, and 21,000 cfs over the auxiliary spillway. The freeboard under these conditions will be 12 ft.

Quarry Site Ideal

The quarry site is located in a sandstone formation bedded with shale of varying thickness. The sandstone is composed of fine grains, mostly quartz, cemented with calcium carbonate, thin to massive bedded, and is characterized by cross jointing which makes it ideal for the vast quarry run rock fills required. When disturbed by blasting, the formation breaks into pieces which can generally be handled by a 3-cu yd dipper without much secondary blasting. This formation is ideal for coyote tunnel blasting, which method was followed exclusively instead of the conventional well-drill method previously used by the TVA on all its large quarry operations.

The length of the adits to the tunnel system is limited by the slope of the mountain, the inside end of the adit being left with not much more than a 100-ft cover. Where more than one level was required, the levels were spaced about 100 ft apart. The adits were used only for access to and from the cross-cuts and were spaced 150 to 200 ft apart. All cross-cuts were perpendicular to adits in the horizontal plane (Fig. 2). The first cross-cut

TABLE I. COST OF LOOSE ROCK USING COYOTE TUNNELS

Based on Production of 3,285,000 Cu Yd Obtained from Three Blasts

Tunnel Driving (11,273 lin ft)	
Labor	$ 209,769.71
Air and water	44,311.80
Drill maintenance	42,489.76
Trucks and equipment operation	17,336.12
Explosive supplies	41,376.26
Power, lights	4,955.93
Miscellaneous expense	5,844.07
Total direct cost, $32.47 per lin ft	$ 366,083.65
Blasting (2,686,292 lb of explosive)	
Labor	40,213.35
Air and water	5,839.31
Nitramon, 2,686,292 lb	369,034.79
Primers, 380 (21,408 lb)	3,175.69
Primacord, 63,000 lin ft	1,856.71
Sand for stemming, 8,750 tons	23,154.82
Burlap bags, 49,275	4,636.78
Trucks and equipment operation	18,995.95
Miscellaneous expense	3,281.74
Total direct cost, 17.5 cents per lb	$ 470,159.34
Additional Quarry Costs:	
Sealing after blasts (estimated)	2,000.00
Secondary drilling (estimated)	95,000.00
Stripping quarry site	186,867.71
Total	$ 283,867.71
Total Direct Cost	1,120,110.60
General job facilities, 16 percent*	179,217.70
Total cost of loose rock	$1,299,328.30
Cost per cu yd ready to load into trucks	$0.396

* Includes supervision, warehousing, small tools, maintenance of job roads, job lighting, drinking water and water boys, fire protection, transportation of workmen, car mileage of general foremen.

DUST FROM cross-cut tunnels appears (upper photo, left foreground) at instant record blast (No. 2) is fired. Thirty minutes before firing time, area within 3,500 ft of blast was cleared of all persons except small firing crew. Few seconds after blast is fired (lower photo) rock mass reaches top of its rise. Compare tree line with that in upper photo. Single blast provided 1.8 million cu yd of quarry-run rock for South Holston Dam.

was turned off about 50 ft from the portal and the rest were spaced at 50-ft intervals. Mucking is the most time-consuming of the driving operations; therefore to save time in wheeling the muck into the adit the length of the cross-cuts was kept under 100 ft. All tunnels drained toward the portals. The arrangement and size of the charges for blast No. 2 are shown in Fig. 2.

Tunnel headings were drilled 4 ft wide and 6 ft high, about the smallest size of tunnel that could be conveniently driven. Each heading was drilled with drifters mounted on columns using 7-ft steel. The drilling and firing pattern was the so-called "hammer cut." Starting with a single heading in one adit, additional headings in the cross-cuts were started as their positions were reached. At the driving peak there were often 12 to 15 headings going at one time. After the miners had drilled out and fired a round they moved to another heading where mucking had been completed. As many as twenty 5-ft rounds were often fired per day.

Tungsten-carbide bits were used because of the excessive abrasiveness of the quartzite rock. These bits gave excellent service and although they are high priced as compared to standard steel bits, their use in hard rock results in considerable saving.

The muck in the cross-cuts was hauled to the adit in wheelbarrows and dumped. It was then pulled to the portal with collapsible drag scrapers connected in tandem, which were moved back and forth along the tunnel by a two-drum electric hoist outside the portal. Only enough muck was removed from the tunnel to permit a rather difficult passage for the workmen.

The required amount of explosive was computed after the volume of rock above each cross-cut had been accurately determined. It varied from about 1 lb per cu yd of solid rock over the outside tunnels to about 2 lb over the inside tunnels. The computations were directed by du Pont's technicians, who were present at all times to render technical assistance and advice. No fixed rules were used to distribute the charges of explosive along the cross-cuts. Distribution depended on many variables and to a great extent on the experience and judgment of the quarry superintendent and blasting technicians. Among the variable factors considered in planning the large blasts were the following: Geologic characteristics of the formation including tightness and thickness of bedding, jointing, direction of dip, hardness, and extent of weathering; depth of cover; spacing of tunnels; and condition of rock at the end of the tunnels. The desired direction of movement and fragmentation of the entire block of rock was also predetermined and controlled.

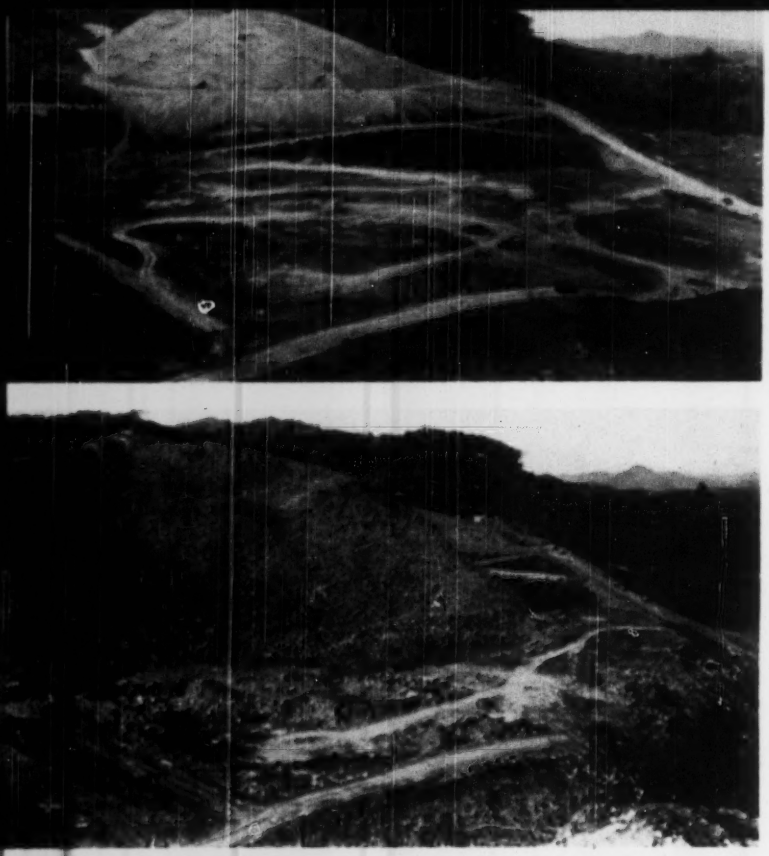
Method of Firing

The explosive used throughout all three blasts was pulled in cans on sleds into the tunnel and placed in stacks of varying amounts at intervals along the cross-cuts in accordance with the loading plan. Two special primer cartridges, without which the Nitramon could not be detonated, were placed in each stack. Loading started as soon as an adit had been

TABLE II. COST OF PLACING QUARRY-RUN ROCK FILL IN DAM FILL

Based on 2,225,812 Cu Yd in Place

Items	Cost per Cu Yd	Total
Loading:		
Labor	0.022	$ 47,888.35
Shovel and tractor operation	0.165	367,974.75
Miscellaneous expense	0.002	4,061.54
Total loading	0.189	$ 419,924.54
Hauling:		
Labor	0.003	7,415.34
Truck and other equipment operation	0.208	462,714.15
Haul road maintenance	0.007	15,170.76
Haul roads, first cost	0.013	28,935.56
Total hauling	0.231	$ 514,235.81
Placing:		
Labor	0.024	53,936.30
Tractors and other equipment operation	0.038	83,442.35
Water for sluicing	0.021	45,662.03
Miscellaneous expense		870.12
Total placing	0.083	183,910.80
Total direct cost of handling	0.503	1,118,071.15
General job facilities, 14 percent	0.070	156,529.96
Total cost of handling from quarry	0.573	1,274,601.11
First cost of rock	0.396	881,321.55
Total Cost of Rock in Place	0.969	$2,155,922.66



PORTALS for coyote tunnels of two-level blast (No. 1) appear on side of hill (upper photo). Utilizing over 800,000 lb of explosive, blast produced nearly one million cu yd of loose rock. After blasting, 66,000 cu yd of rockfill were in place without further handling (lower photo).

completed. The time required to load a large system of tunnels is usually several weeks, but with Nitramon it was considered safe to load in a completed tunnel while drilling and blasting were going on in an adjoining tunnel only 40 or 50 ft away.

Primacord Bickford, used for detonating, is made of an explosive core of penta erythrite tetranitrate (PETN) enclosed by a waterproofed textile covering. When fired it is, for practical purposes, instantaneous, shooting at a velocity of 20,350 fps. It is used extensively in well drilling and tunnel blasting because it is light yet strong, and comparatively safe. Although it is quite insensitive it is sufficiently strong to be a very effective detonator. Primacord is almost always used for detonating Nitramon, the combination providing a high degree of safety.

After the Nitramon stacks were in place in the cross cuts, they were connected by a single line of Nitramon cans laid on the tunnel floor. Two lines of fuse were run along each cross-cut and connected to the two primers in each stack. In the adit the fuses were connected to two main firing lines leading to the portal. All fuse lines were laid between bags of sand along the floor to protect them from damage. At frequent intervals the two fuse lines were connected together, making it impossible for a break or misfire in any line to isolate any part of the charge.

After all the fuse lines were laid in the tunnels, the adits were stemmed with sand so as to get the full effect of the explosion where it was wanted. No sand was placed in the cross cuts except in a few cases, where they ended close to the face with a small burden. After a few experiments it was found that the sand could be blown into place through a 6-in. pipe with a 1-cu yd concrete gun. The gun also elevated the sand from the lower to the upper portals in the two-level blast. This procedure was of great assistance since the upper portals were usually inaccessible to trucks.

The Primacord leads from the adits were connected to a double Primacord bus circuit the day before firing. A few hours before firing time, several No. 6 electric blasting caps were taped to the bus circuit near each adit portal and at other strategic points, the wire leads from the caps being connected to a No. 6 insulated wire firing circuit. The entire charge in each blast was fired simultaneously with 220 v from a point about 3,000 ft distant. No delay devices were used. It was possible, however, to get a slight delay if desired because of the time element in the detonation of the Primacord. The length of the delay period could be predetermined by the position of the caps on the bus circuit.

Firing time was set at least a week ahead. A constant watch was kept after the adits had been connected with the outside bus. The blasting caps were not connected to the bus circuit until just before firing time. New insulated copper wire was used for every blast between the charge and the firing switch. Two firing switches in series were locked open in the circuit, and the only keys were in the hands of the electrical foreman. The area within a 3,500-ft radius of the blast was cleared of all persons except a small firing crew thirty minutes before firing. This crew made the last galvanometer check on the exploders, connected the firing circuit at the blast to the leads to the switches, and hurried to the firing

TABLE III. COYOTE TUNNEL BLAST DATA

Items	Blast No. 1	Blast No. 2	Blast No. 3
Adits driven, number of	5	3	2
Total length of adits, lin ft	1,109	1,177	720
Total length of galleries, lin ft	2,974	4,077	1,306
Total length of tunnels, lin ft	3,993	5,254	2,026
Working time to drive, days	54	106	34
Average advance per day, lin ft	74	50	60
Quarry volume over tunnels, cu yd	512,758	931,935	269,100
Estimated quarry yield, cu yd	925,000	1,800,000	560,000
Solid rock per ft of gallery, cu yd	172.4	228.6	206
Total explosive, lb	844,503	1,362,985	501,102
Primers used, number of	378	436	164
Explosive per ft of gallery, lb	283.8	334.3	384
Explosive per cu yd of solid rock, lb	1.64	1.45	1.86
Explosive per cu yd of loose rock, lb	0.91	0.70	0.90
Blasting date	7-14-48	2-5-49	4-16-49

position. The first switch was then closed. On the exact second, the second switch was closed, firing the blast.

The timing was done by the Carnegie Institution of Washington with time signals from the Bureau of Standards. The former organization and other scientific groups took advantage of this unprecedented opportunity to measure the distance and rate of travel of the tremor through the earth's crust with a string of seismographs across the continent.

Yield of Broken Stone High

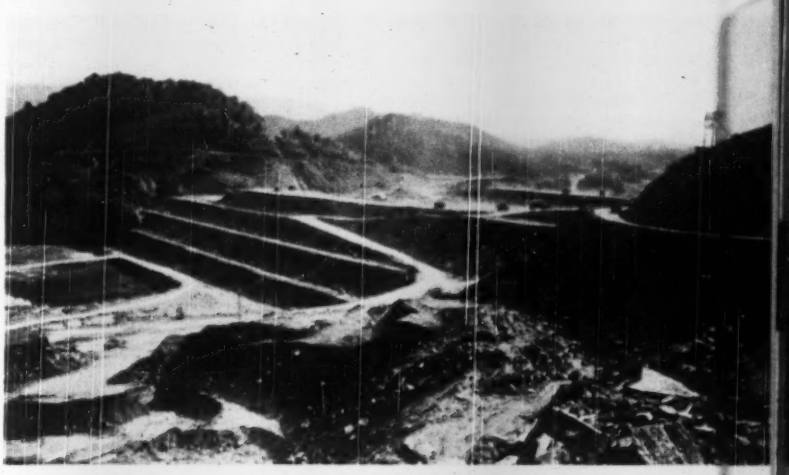
The tunnel method produces cheap rock if the geologic conditions are suitable and the work is done under skillful supervision. The three blasts at South Holston produced about 3,285,000 cu yd of loose rock laid down on the quarry floor for about 29 cents per cu yd. When the cost of stripping, scaling, and secondary blasting was added, the cost, ready for loading into trucks, was about 40 cents per cu yd. See Tables I and II.

Tunnel shots made in the face of a steeply sloping mountain produce an exceptionally high yield of broken stone because the overbreak extends a great distance up the face. Estimating the natural swell in the blasted rock at 50 percent, and assuming a conservative overbreak, it is safe to estimate the yield in broken stone under ideal geologic conditions at twice the volume of solid rock over the tunnel system. See Table III for coyote tunnel blast data.

Stripping varies at each site, as does the amount of secondary blasting. The latter is indicative of the effectiveness of the blast and the geology of the rock. It is also dependent on the size of the dippers on the loading shovels. At South Holston the stripping cost 6.6 cents and the secondary blasting 3.4 cents per cu yd of rock.

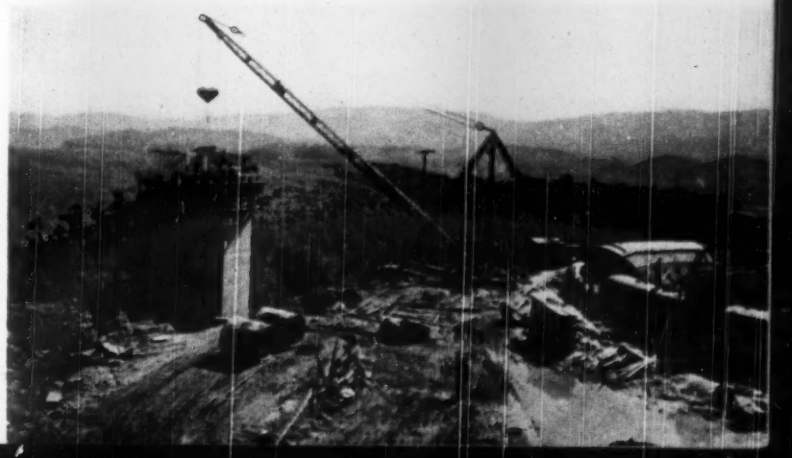
The Upper Holston Projects were designed and are being constructed by the Tennessee Valley Authority under the general supervision of C. E. Blee, M. ASCE, Chief Engineer. E. C. McClenagan is Construction Superintendent, with Robert F. Taylor and Paul H. Jones, Assistant Construction Superintendents, directing construction at South Holston and Watauga Dams respectively. Oren Reed, M. ASCE, is Construction Engineer. W. D. Simpson, Tunnel and Quarry Superintendent, was in direct charge of tunnel driving, loading, and firing of all blasts. F. D. Bickel and R. C. Brown, Assoc. M. ASCE, of the DuPont Company, were the technical advisers.

QUARRY-RUN ROCK from blast No. 2 is loaded by 3-cu yd shovels into rear-dump Euclids. Cuts were kept to 40-ft maximum to prevent slides. Very little secondary blasting was necessary.



UPSTREAM ROCK FILL rises in 30-ft lifts. Power tunnel intake can be seen at right, just below truck on curve. Sluice control tower and morning-glory spillway appear in left background.

STIFF-LEG DERRICK raises forms prior to pouring of next lift of sluice control tower. Rim of morning-glory spillway nears completion, to right of derrick, as workmen place forms for one of six baffles, placed around rim of spillway to eliminate surges and pulsations, and to produce uniform flow in shaft.



Engineers' Notebook

Glass-Walled Flume Provides Flexibility in University of Texas Laboratory

WALTER L. MOORE, Assoc. M. ASCE
Associate Professor of Civil Engineering, The University of Texas, Austin

INFORMATION on hydraulic laboratory equipment is difficult to obtain, a fact well known to those endeavoring to expand or improve on facilities of this kind. The glass-walled flume recently installed in the hydraulic laboratory at the University of Texas incorporates a number of features of interest to engineers concerned with this problem.

Flume Designed for Maximum Versatility

Since the original equipment installed in the university's hydraulic laboratory in 1933 was designed for conventional calibration-type experiments, this first major addition to the facilities was designed to serve as many purposes as possible until such time as more specialized equipment can be added. It is expected that the flume will be used for research and model tests on two-dimensional flow problems except for one semester a year, when it will be used in an advanced laboratory course dealing mainly with problems of free surface flow. Experiments also can be made on uniform and non-uniform flow at various slopes, although a longer channel would be desirable for these problems. An additional section which can be attached to the downstream end with a hinged joint, is contemplated for this purpose.

The general appearance of the flume is shown in the photograph, and the basic dimensions are indicated in Fig. 1. In both illustrations the flow is from right to left. Essentially the apparatus consists of a glass-walled flume 24 ft long, the first 6 ft being 46 in. deep and the remaining 18 ft, 22 in. deep. Water from an overhead pipe is fed into the stilling tank, where it passes through an 18-in. loose-rock baffle and a contracted transition to quiet the disturbances from the feed pipe. The whole unit is mounted on a welded steel truss which in turn is supported at three points by screw jacks.

Flume dimensions were based on a maximum discharge of 4 cfs which for the width of 1 ft gives a maximum critical depth of 0.79 ft. If it be assumed that a critical depth of 0.15 ft is a minimum value to insure against effects of surface tension, a spillway or fall with a height of 23 times the critical depth can be installed in the deep section of the flume.

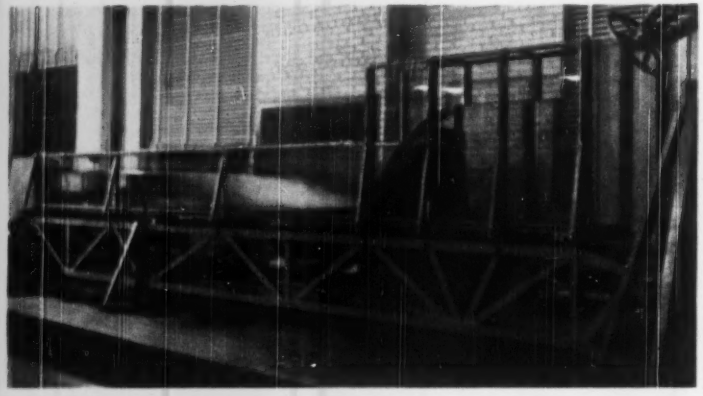
Danger of Breakage of Glass Walls Reduced

The side walls are transparent to permit visual and photographic observations of flow patterns. Glass was used because of its permanent transparency and its rigidity against deflection under the force of the water. Its hardness resists abrasions and scratches which in time would impair the transparency of softer plastic materials. However, the rigidity and brittleness of glass causes serious danger of damage due to deformation of the supporting framework, and therefore careful attention was given to making the framework rigid and to providing for cushioning at the edges of the glass.

The back of a 12-in. standard steel channel forms the flume's bottom surface. The supporting framework below the channel was made as open as possible so that piezometer connections can be made to nearly any point on the bottom by drilling the steel channel and inserting a plug containing a piezometer hole. The piezometer plugs will be of soft material and after installation will be sanded down to be flush with the channel bottom.

Provision was made for a convenient method of adjusting the slope of the flume so that investigations can be made of the surface curves of non-uniform flow, of standing waves at critical depth, of periodic surges for flow in steep channels, and other problems which depend on channel slope. The slope is adjustable by screw jacks to a maximum of 13 percent in the direction of flow, or to an adverse slope of nearly 10 percent.

The entire unit is supported on three screw jacks, one under the



MODEL OF AUSTIN DAM SPILLWAY, at scale of 1:30, undergoes test in glass-walled flume recently installed in University of Texas Hydraulic Laboratory. Flume is designed chiefly for study of two-dimensional problems in connection with spillways, stilling basins, weirs, sluice gates, free falls, hydraulic jumps, and transitions with change of elevation.

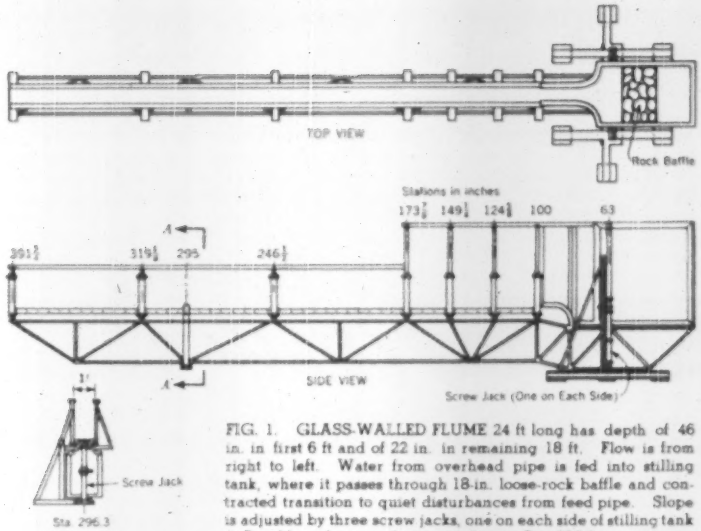


FIG. 1. GLASS-WALLED FLUME 24 ft long has depth of 46 in. in first 6 ft and of 22 in. in remaining 18 ft. Flow is from right to left. Water from overhead pipe is fed into stilling tank, where it passes through 18-in. loose-rock baffle and contracted transition to quiet disturbances from feed pipe. Slope is adjusted by three screw jacks, one on each side of stilling tank at Sta. 62, and one under center line at Sta. 296.3.

center line of the flume at Sta. 296.3 (inches), and one on each side of the stilling tank at Sta. 62. The jacks are shown in the photograph. Normally the two jacks at the head of the flume will be set at a slight extension and the slope will be adjusted by means of the single jack at Sta. 62. For the extreme limits of slope, the head jacks will be set to the limit of travel and the final slope adjustments made by the single jack at Sta. 62. The jacks are of the double-lead-screw type adapted from a commercial push-pull jack. At each jack a slot formed from structural steel members guides the path of movement. When a jack is adjusted to correct elevation, a clamp is tightened to eliminate looseness in the guide slot and to fix the flume solidly to the supporting stands. The vertical reactions, however, are always carried by the jacks.

Rate of discharge is measured by an elbow meter using one of the welded miter elbows in the supply pipe. This meter was calibrated in place, and gave a linear calibration curve when the data were plotted on logarithmic graph paper, indicating that the differential head was proportional to the square of the discharge.

Design of the steel box truss which supports the flume and stilling tank was based on the need for rigidity. The section properties of the truss were determined so as to prevent exceeding a safe stress in the glass walls due to bending of the truss. The locations of the jack points were chosen to produce equal positive and negative moments at the center of the span and at the supports.

The truss was made from structural steel angles with the diagonal members in the four planes welded directly to the chord angles. The legs of the chord angles were turned inward and the diagonal members were welded on the inside to give a neat appearance.

The flume proper is supported on threaded studs welded to the top chord of the truss at the panel points, making it possible to line up the flume bottom even if the truss is warped by welding. These adjustments, together with some local pressing of the steel channel, resulted in a flume bottom of good alignment—within 0.01 in. of a true plane, as indicated by measurements.

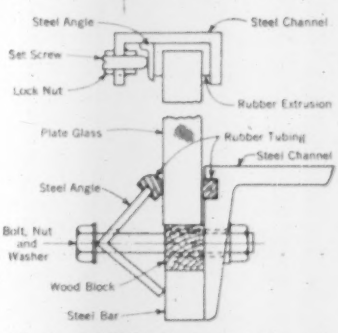


FIG. 2. MOUNTING of plate-glass walls of flume, here seen in cross section, provides careful cushioning to avoid breakage under pressure of water and structural stresses. Glass is protected against contact with steel at all points. Rubber cushion covers top edge; continuous rubber tubing runs in milled slot of steel channel at right; supporting steel angle at left is edged with rubber tubing; and wood block supports weight of glass at lower edge.

Two Major Sources of Difficulty Met

Two problems that were expected to give the most trouble in fabricating and operating the flume were the protection of the glass against breakage and the sealing of the joints against leakage. Therefore particular attention was given to details affecting these items.

The seal at the bottom edge of the glass is made by squeezing it between two pieces of rubber tubing, giving line contact at the sealing surface. Figure 2 shows a cross section of the glass mounting. A continuous rubber tube runs the length of the bottom channel in a milled slot and forms a seal as the glass is pressed inward by an angle clamp bearing on the outside surface of the glass opposite the sealing tube. Fluid pressure can be applied to the inside of the sealing tube, forcing it out against the glass, should there be leaks due to insufficient contact pressure. Since the sealing tube supports the glass clear of the flange on the steel channel, there is no chance of fracture due to edge moments introduced by clamping the glass against a misaligned surface. The weight of the glass is supported by a wood block under its lower edge.

At the top edge, the glass is supported inside a 2-in. steel channel which runs the length of the flume. The glass is protected by a $\frac{1}{8}$-in. thick rubber cushion and is clamped firmly in place between a steel angle and the flange of the channel.[1]

Joints in the glass are spaced longitudinally at 2-ft intervals in the deep section and at 6-ft intervals in the shallow section. At each joint a steel post supports the glass from the outside and also supports the steel channel which runs along the top edge of the glass. A rubber strip acts as a cushion at the point of contact between the glass and the steel post. A vertical groove in each post forms a convenient method of installing weir plates, sluice gates, or other apparatus. These grooves are lined with

[1] The writer has recently learned that at the Iowa Institute of Hydraulic Research similar glass panels have been successfully mounted and sealed by use of a new plastic cement. When cured the cement adheres firmly to the glass but remains flexible to guard the glass from harmful deformations. This method appears to be more economical than the one here described.

stainless steel inserts, thus eliminating wear on the cadmium plating on the posts. Grooves not in use are filled with a non-hardening calking compound, to form a surface that is flush with the inside surface of the glass.

Cadmium plating was used on the posts at the glass joints and on all nuts and bolts to prevent corrosion. All other surfaces are protected with paint.

Costs have increased so rapidly in the past few years that records of cost are of less significance than in normal times. However, the following approximate figures are presented for those who may be interested. The flume was fabricated in the shops of the Tips Engine Works in Austin, Tex., and the glass was installed after the flume was moved into position in the hydraulic laboratory. The total cost of the completed flume, including glass sides and final assembly work, was approximately $3,850. Other items, such as the supply pipe and the waste chute, amounted to about $400 additional.

Other solutions to some of the problems encountered in the design of this flume will undoubtedly occur to engineer readers, and it is hoped that they will feel encouraged to contribute to the available information on hydraulic laboratory equipment by publishing their ideas and experiences.

..THE READERS *Write*

Similarities Noted Between Road Construction in Alaska and in Northern United States

To the Editor: The remedy for a condition often encountered in northern parts of the United States is described by Professor Ekse in his article, "Wet Silt Under Base Course Damages Alaska's Glenn Highway," in the January issue. In the case described, in Alaska, permafrost was a contributing factor while, in the continental United States, annual frost action is the corresponding factor. Since the permafrost usually retreats a considerable distance beneath the road surface during and following construction, any recurrence of subgrade softening would no doubt be caused by annual frost action rather than by permafrost.

Use of a sand blanket between the gravel base and the underlying silt, to act as a filter and prevent intermixing of gravel and silt, is a very satisfactory solution. The grain size information given is somewhat incomplete, but it does indicate that probably the sand will perform its function satisfactorily. The criteria given on page 50 of Terzaghi and Peck, *Soil Mechanics in Engineering Practice*, can be used to determine whether such a sand will act as a filter. Also, the gravel should be checked for its ability to act as a filter with respect to the sand.

The 4-ft thickness of gravel blanket appears about right for the conditions encountered. It is not uncommon to use such depths of gravel in the northern parts of this country beneath roads where the underlying material is a loose, wet silt.

The decision to place 1 ft of selected borrow over the existing road surface in areas where the silt was encountered, but where the road did not break up, may not prove entirely satisfactory. In future years, conditions may be such that the subgrade silt in these areas will develop excessive frost action with resulting softening during a thaw and breakup of the road surface. Silts such as that described are the worst offenders as far as frost action is concerned.

As for the design of airport pavements to withstand annual frost action, extensive research is being carried out by the Corps of Engineers. A report on these studies, which apply equally well to the design of highway pavements, has been published by the Frost Effects Laboratory, New England Division, Corps of Engineers, Boston, Mass.

William L. Shannon,
Assoc. M. ASCE
Beaverton, Ore.

Origin of Report on N.Y. Housing Costs Explained

To the Editor: In the February 1950 issue, page 20, appears a summary of the paper given by Francis Tompkins, Assoc. M. ASCE, "Simplification Can Save Money on Government Buildings," as part of the program of the ASCE January meeting. In the printed summary, reference was made to a report prepared by the Citizens Housing Council in 1941, which it is stated, was headed by Dr. Jacob Feld. This statement is not quite correct. Apparently the author meant that I was chairman of the committee which prepared the report.

The report, incidentally, is entitled "Methods of Reducing the Cost of Construction in Large-Scale Housing Projects," issued in February 1941 by the Citizens Housing Council of New York and prepared by a Committee on Construction Cost Economy consisting of W. F. Ballard, Ralph Eberlin, Walter H. Maitland, Albert Mayer, R. V. Parsons, C. S. Stein, and myself as chairman. This statement is made to correct any misunderstanding that might arise as to the relationship of the report to the Citizens Housing Council.

Jacob Feld, M. ASCE
Consulting Engineer
New York, N.Y.

"Proceedings" Separates Called Benefit to Members

To the Editor: The Committee on Technical Publications is to be complimented on the decision to print the Proceedings in separate papers.

In all the vast amount of information published in the Proceedings there is bound to be a considerable number of papers which will be of little or no interest to the average civil engineer; consequently the individual member of the Society can, in this manner, order separate papers which will fit his individual needs. The over-all cost to the Society will be decreased and the over-all benefit should be increased.

Forrest E. Jones, M. ASCE
Engineer
Kansas City, Mo.

Value of Technical Competence Emphasized

To the Editor: The article by Mr. Perry, "Engineers Play Vital Role in Building Construction," in the January issue, is interesting. That portion of the article on page 25 under the heading, "Good Future for Engineers," may appeal not only to experienced engineers but also to students in engineering. To prevent the drawing of hasty conclusions unfair

(*Continued on page 92*)

SOCIETY NEWS

Los Angeles Sets Stage for Spring Meeting, April 26–29

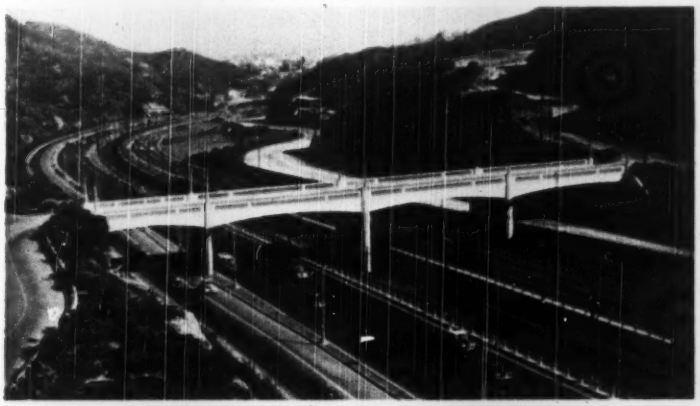
HARD-WORKING MEMBERS of the Los Angeles Section have prepared a Spring Meeting program that is notable not only for the range of technical interests served in the Division sessions and engineering inspection tours, but also for a schedule of social events that will give a real glimpse of Western hospitality. A detailed program of the meeting, to be held jointly with the Third California Conference of Local Sections, is printed elsewhere in this issue.

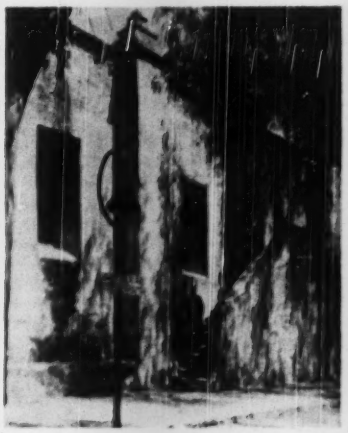
All but one of the Society's 13 Technical Divisions have scheduled 20 sessions, which will occupy the better part of three days. There will also be a luncheon on Wednesday under the auspices of the Construction Division and one on Thursday under the Sanitary Engineering Division. On April 28 all the Divisions are sponsoring an all-day general session devoted to the Terminal Island subsidence problem, a matter of prime concern to engineers and industrialists in the Los Angeles area. In addition to an inspection trip to Terminal Island supplementing the Friday program, a number of tours have been planned to give the Spring Meeting visitors an idea of the tremendous engineering and industrial developments under way in Southern California.

Large Student Conference

The Student Chapter Conference and speaking contest, which is a traditional feature of the annual California Conference, is given considerable prominence in the joint program. ASCE President Ernest E. Howard will address the group at a Student Chapter luncheon on Friday, which will feature an all-day program of student papers and discussion of Student Chapter and vocational problems. Student Chapter members are invited to attend the Society's get-acquainted stag dinner and smoker on Thursday evening, and a special all-day field trip has been arranged for them on Saturday.

The interests of another group of

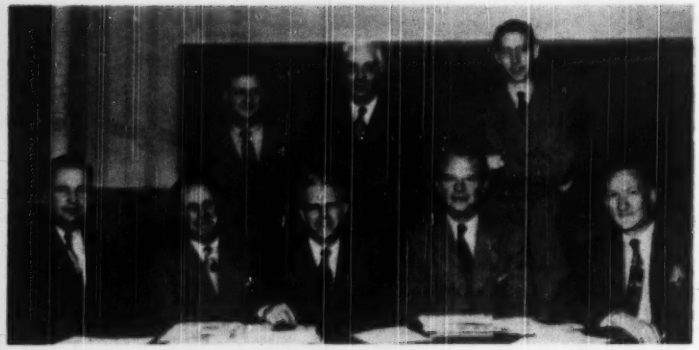




CAHUENGA PASS (upper left-hand photo), one of numerous arterial highways in California's ambitious program of throughways to reduce traffic congestion in metropolitan areas, follows route of old Indian trail through Hollywood Mountains. Hollywood lies in background, and Hollywood Bowl in mountains in right background. Roosevelt Highway (lower left view) passes Pacific Palisades in Los Angeles County. Photo shows one of many beautiful beaches available to Los Angeles residents. San Gabriel Mission (below), lying 13 miles northeast of city, has been in continuous use since its establishment in 1771.

younger men will be served at a Junior Forum Luncheon on Thursday. Sigmund L. Levin, member of the Junior Forum of the host Section, will act as toastmaster of the program, which will feature a talk by A. M. Rawn, chairman of the Society's Committee on Salaries, on "What the Employer Wants from the Young Engineer."

The many other Spring Meeting activities will include a two-day Local Section Conference on Monday and Tuesday preceding the meeting proper; a special dinner on Tuesday evening, with a talk by Clarence A. Dykstra, vice president of the University of California and provost of U.C.L.A.; a Western Region Faculty Advisers' Conference on Thursday; and an innovation in the form of an Authors' Breakfast, which will give all contributors to the written or spoken Spring Meeting program an opportunity to discuss common problems of expression.



NEWLY ELECTED OFFICERS OF LOS ANGELES SECTION photographed at recent joint meeting with the University of Southern California Student Chapter, are (left to right, front row) Homer W. Jorgensen, secretary; Paul Baumann, vice-president; Robert R. Shoemaker, president; Linne C. Larson, vice-president; and Ralph C. Durke, treasurer. In back row, in usual order, are former officers Ray L. Derby, D. Lee Narver, and Stanley Butler.

Are You Informed on the Proposed New Constitution?

Digest of Statement Prepared by New Constitution Committee

At the business meeting of the Society in New York on January 18, 1950, a final draft of the proposed new constitution was ordered to ballot. This draft differs in a few respects from the first printed "Proposed New Constitution" accompanying the petitions, in that it includes amendments pertinent to the petitions, which were offered and adopted at that business meeting.

Following the business meeting, the Board of Direction appointed a New Constitution Committee, with Past President Thomas as chairman. Other members of the Committee are Waldo Bowman, Robert B. Brooks, Albert Haertlein, Arthur Harrington, Paul Holland, and Henry J. Sherman. Its purpose is to inform the membership on the details of the proposed new constitution; to impress every member with his duty to inform himself on this important matter; and to urge him to vote upon it at balloting time early in April.

The first step taken by this special committee was to prepare for mailing to each member of the Society in every grade a copy of the proposed amended constitution accompanied by a statement which discusses its several articles, compares them with corresponding provisions of the present constitution, and attempts to cover all criticisms of the document of which the Committee was then aware. Additional copies are available upon request from Society Headquarters. The following abstract highlights the statement.

Our constitution, in the same general pattern as it exists today, was first adopted by the Society in 1877. Amended many times between 1877 and 1921, it was generally revised in that year. Since 1921 further amendments have been adopted. Some of the language of the present constitution is ambiguous and even some impossibilities are prescribed. The remarkable growth of the Society, and the greatly expanded activities in Technical Divisions and Student Chapters since 1921 has made highly desirable a remodeling of this basic corporate document of the Society.

Membership Grades

In the article concerning Membership the term "corporate member" is dropped for the term "member" and is applied to all three principal grades of membership. The specification for those eligible for membership has been reworded to clarify the requirements for the different grades.

The grade of "Fellow" has been dropped. The designation "Junior" has been changed to "Junior Member." The minimum age for Associate Member has been lowered from 27 to 25 years and the maximum age for Junior Members has been lowered from 35 to 32 years. This brings the Junior Member upper age limit back close to what it was before World War II. Fear has been expressed that the lowered limit for Junior Members, when they must be transferred to a higher grade, would put difficulties in the way of young veterans who were forced to postpone their university training because of the war. Such is not the case. The proposed new constitution makes provision for extension of the upper age limit for Junior Member veterans by the Board of Direction whenever necessary.

Advocates of the ECPD recommended uniform grades of membership proposed that they be included in the new draft of the ASCE constitution by amendment at the business meeting of the Society on January 18, 1950. Advice of Society's counsel on this proposal was to the effect that it would not be "pertinent" to the "amendments" upon which the original petitions for change were based, as is required by Section 3 Article X of the present constitution.

Fees and Dues

No change from present basic dues or in the differential assigned to members in District 1 is made in the new draft. It provides for reciprocal exchange of memberships between the Secretary of ASCE and corresponding officers in similar national engineering institutions and societies to be named by the Board of Direction. This new provision is made to facilitate cooperation between ASCE Headquarters and the headquarters of similar societies, American and foreign, and also to provide for full exchange of technical publications at reasonable cost.

The present constitution provides two criteria under which members who have paid dues for many years may achieve exemption from the payment of further dues. In the proposed constitution, one of these provisions is retained—that is, for Members, Associate Members, and Affiliates who have reached the age of 70 and have paid dues as such for 25 years. The other provision, which grants dues exemption after payment for 35 years regardless of age, would be dropped

for all new members but of course be retained for all present members. This deletion is proposed because many engineers who have received life membership status prior to age 70, are still in their highly productive years when it is no hardship for them to continue to pay their share of Society benefits that all members receive. There are at present 2,240 life members, who constitute 13 percent of the corporate membership.

Districts and Zones

There is no basic change in the new draft over the provisions for the delineation of Districts and Zones in the present constitution. The spontaneous growth of regional councils of Local Sections during the past few years in several parts of the country prompted the drafting committee and the Board to include a provision to give official Society status to their establishment.

Nomination and Election of Officers

There are no fundamental changes in the nomination and election of officers in the new draft. Procedure for the nomination of the President remains unchanged. No changes in the fundamental principles or procedures of a secret letter ballot are contemplated in the nomination and election of the other elective officers. The detailed method under which such balloting would be done will be transferred to the by-laws. Vice-Presidents and Directors will continue to be nominated by letter ballot of the members in their respective Zones and Districts. To emphasize the fact that they are truly the representatives of their respective Districts and Zones they would then be elected by the same electorate rather than by the entire membership.

A new thought introduced provides for shortening or lengthening in special cases the terms of office of elected officers of the Society before their election. This modification is necessary during periods of transition occasioned by constitutional amendments or redistricting in order to continue the practice of electing one-third of the Board of Direction each year.

Three Business Meetings Annually

In the new draft of the article on meetings the most noticeable change from the old constitution is the shift in the date of the Annual Meeting from January to October. There were two basic reasons for the change. The present intent of the Board of Direction is to change from four stated meeting a year to three. This detail will be set up in the by-laws where it belongs. Mid-January in New York frequently provides about the worst weather of the year, greatly handicapping trips to engineering works and to other places of interest. January also is one of the most difficult months in which to obtain hotel space in New York. October, on the other hand, is a pleasant month in New York, and traveling conditions are favorable.

One general business meeting of the Society is fixed in the new draft at the time of the October Annual Meeting in New York. It is the intent of the Board of Direction to make provision in the by-laws for at least two more business meetings each year.

Local Section Funds

Some Local Section officers have called attention to the omission in the new draft of language relative to Society allotments to Local Sections. There is no intent on the part of the Board of Direction to change present practice of assigning funds of the Society to Local Sections. The language in the present constitution, is that "The Board of Direction may annually assign" funds to Local Sections. The drafting committee and the Board of Direction saw no point in retaining this language in the revised constitution, since full powers over the funds of the Society are assigned to the Board of Direction elsewhere in the new constitution. There appeared no more point in stating an optional budgeting of funds to Local Sections than there would be in making similar statements relative to Technical Divisions, Professional Committees, Technical Publications, or other Society activities.

As rewritten, the new article coficerning Amendments departs in but one particular from the present constitution. This difference is in the specification of the number of signers required on petitions to place an amendment of the constitution before the Society for consideration. The present constitution requires 75 signers from each of the four Zones; the new draft sets the number at 200. When the present constitution was adopted Juniors were not entitled to vote. Then less than 12,000 corporate members had the vote. At present, Juniors have a vote, and the total voting membership of the Society now is over 28,000.

Vote Urged

It is the duty of every member to fully inform himself before he votes and, when he receives the official ballot, to exercise his right to vote. It is the purpose of the Board of Direction to acquaint every member with the reasons behind the proposed changes. Members of the Board, or the Special Committee are available on request of Local Section officers to discuss the proposed new constitution with members in their Districts or Zones.

The specially appointed New Constitution Committee and the Board of Direction take the position that the proposed constitution is a much clearer, shorter, and better document than the present constitution. As the need for future amendment develops, new amendments can be adopted. If the amended constitution is adopted, the by-laws will, of course, be amended accordingly.

The Board of Direction recommends that the membership adopt the new constitution.

Criticism of Proposed Constitutional Amendments Answered

HENRY J. SHERMAN, Senior Vice-President ASCE, and Member, Special New Constitution Committee

ELSEWHERE IN THIS section of CIVIL ENGINEERING is a digest of an information circular prepared by a special New Constitution Committee. In every corporation, be it based on the holding of stock or of individual membership, there always is found a minority view on every major proposal made by the corporation management. Expression of such minority views is a proper and healthy demonstration of interest.

Our Boards of Direction always have given careful consideration to the views expressed by any member or any Local Section on any Society matter. In connection with the proposed new constitution, our Boards of Direction for the past four years have followed that practice. There comes a time, however, when a decision must be made as to when a major corporate question should go before the members or the stockholders for a vote.

In the present case, proper petition had been received to place the matter of amending the constitution before the membership for a vote. The Board of Direction recommended to the January 1950 Annual Meeting of the Society that the membership vote on the new constitution proposal now. The members present at the meeting, several hundred of them, by unanimous vote took formal action to call for a Society-wide ballot on the proposed new constitution without further delay.

Following the January meeting, each member of the New Constitution Com-

mittee, each member of the Board of Direction, and each Local Section received a copy of the monthly publication of a Local Section, the officers of which oppose the proposal. Over the signature of its president, this Local Section recommends a "no" vote on the new constitution. The New Constitution Committee is not informed as to how much farther the circulation of this particular publication went, but it feels that comment on the criticism made will be informative.

The front page example cited in this Local Section publication as to why approval of the amended constitution would be "inimical to the best interests of the membership of ASCE" follows: "The proposed constitution contains no provision for modernization of the membership structure and makes amendments to the constitution more difficult."

Membership Grade Changes Not "Pertinent" To Petition

An editorial in that publication quite correctly states that the proposed constitution does not contain provisions for radical changes in our membership grades, as recommended recently by ECPD. The editorial fails to state that the amendments as petitioned for in this case made no fundamental change in our present grades of membership. The ECPD proposal would change them completely.

So complete a change would not be within either the scope or intent of the membership grades amendment as it was contained in the petition. It is not "pertinent" to the petition, according to Society's counsel. It is in the same category as though the Society had received petitions to raise dues five dollars in each grade and then attempted to amend the petitioned amendment from the floor of the business meeting to make the raise ten dollars instead of five. Such a proposal would be clearly outside the limits of the proposal contained in the petition to bring the original amendment to vote.

Contrary to the quoted statement of the objecting Local Section, the proposed new constitution does provide, as does the present constitution, for the making of amendments in the future for "modernization of the membership structure," and for any other amendment for which petitions are received.

It should not be forgotten that a definite draft of amendments to our constitution, in fact a rewritten constitution, was submitted by petition, as required by the constitution. It is possible at a business meeting of the Society to amend the amendments petitioned for but only in a manner pertinent to them. As thus amended, the proposed amendments automatically must go to ballot. It is also possible to lay the proposal over to the next succeeding business meeting for additional study and final action on amendments to the amendments petitioned for originally. After this, there can be no further postponement of balloting on the proposal by all members.

Amendment Not Difficult

When the constitution amendment provisions now existing were adopted there were but 11,975 members entitled to vote, and an amendment to the constitution could be brought to vote by petition from 75 members in each of the four Zones. Today we have over 28,000 members entitled to vote, and the new proposal is to require 200 signers to a petition from each of the four Zones. Comparison of these figures shows that the ratio of signers to voters would be substantially the same. Moreover, the Society is presently growing at the rate of over 2,500 a year.

To bring facts to the attention of every member, the new Constitution Committee has arranged for an advance information mailing to each member. This mailing will include a copy of the proposed amended constitution as it will go out later to ballot, and an information leaflet discussing every change proposed. Ballots to members in North America will be mailed about March 27, 1950, for return not later than April 19, 1950.

The copy of the proposed new constitution which all will receive will speak for itself. Any member who questions the competency of the four-year study on this subject and the recommendations made by the Board can compare the new draft with the old constitution and draw his own conclusions. The information circular should answer most questions which might arise as to reasons behind changes proposed. The Board of Direction and the New Constitution Committee hope every member will read the proposed new constitution and the information provided. Being well informed and whether for or against the proposal, every member is urged to vote.

ASCE Research Prize Awarded to J. S. McNown

FIRST AWARD OF the ASCE Research Program Prize to Dr. John S. McNown, Assoc. M. ASCE, of the Iowa Institute of Hydraulic Research, was authorized by the Board of Direction at its January meeting. Established in 1946 "to assist in arousing a greater interest in fundamental research and to aid the Committee on Research in securing grants for such research," the program prize consists of a cash award of $100 and a certificate. Administration is under the ASCE Committee on Research.

John S. McNown, Assoc. M. ASCE

Dr. McNown, who receives the program prize for his outline of the project, "Fundamental Research in Sediment Transportation," is well known in the field of hydraulics. He holds degrees from the Universities of Kansas, Iowa, and Minnesota, and has been research engineer and assistant professor of mechanics and hydraulics in the Iowa Institute of Hydraulic Research since 1943. One of his principal research projects has been a study of cavitation and pressure distribution around bodies of revolution—sponsored by the National Defense Research Committee during the war and the Taylor Model Basin of the Navy after the war. In 1947 he received the J. C. Stevens Award for his discussion on "Lock Manifold Experiments" in TRANSACTIONS.

Papers in Daniel Mead Prize Competition Due

JUNIORS AND STUDENT Chapter members are reminded that all entries in the current Daniel W. Mead competition for prize papers on ethics must be in the hands of the Executive Secretary of the Society by June 1, 1950. This year the subject for both Juniors and Student Chapter members is "The Junior Engineer's Idea of His Employer's Ethical Responsibility to Him." Copies of the rules for contestants may be obtained from Society Headquarters, 33 West 39th Street, New York 18, N.Y.

Established in 1939 by the late Daniel W. Mead, Past President and Honorary Member of ASCE, the Daniel W. Mead Awards consist of a Junior prize of $50 in cash and a certificate, and a Student prize of $25 and a certificate.

Director Joel D. Justin, Power Expert, Is Dead

NEWS OF THE death of ASCE Director Joel D. Justin—in Philadelphia on February 21—will come as a shock to his many friends in the Society. He was 68. A consulting engineer, specializing in dams, hydroelectric power, and flood control, Mr. Justin was a member of the Philadelphia firm of Justin & Courtney.

Following his graduation from Cornell University in 1906, Mr. Justin became connected with the New York Board of Water Supply, and later was with the

Joel D. Justin, 1881–1950

Harrisburg, Pa., Board of Public Works, and with James H. Fuertes, New York City consultant, on water supply, filtration, and sewerage work. During the period, 1914–1932, Mr. Justin filled several positions with engineering organizations and power companies in the field of water supply and hydroelectric power. Since 1932 he had been in private practice in Philadelphia—of recent years in partnership with Neville C. Courtney, M. ASCE. He was consultant on the construction or rehabilitation of more than 120 dams, and on such notable works as the Santee Cooper Project in South Carolina; the Clark Hill Power Project in Georgia-South Carolina; the Muskingum Flood Control Project for the Corps of Engineers; and the Denison Power and Flood Control Project on the Red River. He had been a member of the Board of Consultants for the Panama Canal since the board was established early in 1946.

Joining ASCE as an Associate Member in 1911, Mr. Justin became a full member in 1916. He began a three-year term as Director for District 4 in January 1948. He had served on numerous technical committees of the Society and as chairman of the Power Division. He also represented the Society on the board of Engineering Foundation, and in 1949 served as chairman of the Foundation and of its executive committee. Contributor of numerous papers to ASCE and other technical publications, he received the Society's J. James R. Croes Medal in 1924 for a paper on "Design of Earth Dams," and the Fuertes Gold Medal from Cornell University in 1932. He was author of *Earth Dam Projects*, published in 1932, and co-author with Creager and Hinds of several authoritative hydroelectric and power texts.

Creation of National Policy on Water Resources Advocated by EJC

ENGINEERS HAVE LONG been convinced that adequate conservation and development of our national water resources are unattainable under present uncoordinated and frequently opposing policies, and that present practice is detrimental to the nation's economic progress. These conclusions were stressed over a year ago in a January 1949 report to Engineers Joint Council by a Special Panel on Water Policy.

A temporary Water Resources Policy Commission to study the problem and to evolve a policy was appointed by executive order of President Truman just before Congress convened this year. Earlier, the engineers' Panel on National Water Policy had been instructed to take all proper steps available to aid in creation of a Commission that would review present Water Resources Policies and make recommendations to the Congress for revision and restatement.

Engineers Joint Council, at its meeting on January 20, approved a program for outlining the engineering profession's conception of the elements of a sound national water policy. These concepts, when developed, will be presented to the President's temporary Water Resources Policy Commission. (p. 72, February issue).

Under the EJC program established on January 20, its Water Policy Panel is instructed to set up task committees covering various subdivisions of the fields of water conservation, development, and utilization. Members of the profession experienced in these fields are to be sought out through each of the five constituent Societies and asked to accept service on the Committees as a professional contribution to an important national public matter.

The recommendations of the task committees, after review and coordination, will be formally transmitted to the temporary Presidential Commission under the invitation contained in that Commission's press release of January 16, 1950 as follows:

"The Commission decided to include in its procedure an opportunity for all persons and organizations concerned with water resources, including governmental agencies—federal, state, and local—agricultural, labor and business organizations, technical societies, and associations seeking to safeguard particular phases of water resources development, to bring to its attention their conception of the elements of a sound water resources policy for the nation."

Two members of the seven-man Presidential Commission are engineers—Morris L. Cooke, member of ASME, who is the chairman, and Samuel B. Morris, member of ASCE. Since the President has directed this temporary Commission to complete its work by December 1, 1950, it is evident that to be of service, recommendations from the engineering profession should be transmitted to it by July 1, if possible.

EJC Water Policy Panel Seeking Help

Prompt action by the EJC Panel is planned in forming the various task committees. The Panel is now engaged in setting up the number of committees by subject and scope, and in outlining their definite fields of responsibility. Invitations for Committee service are expected to go to selected members of the five national Societies within the next month. Probably all five of the Societies will be represented on certain of the Committees, but this will depend largely on what fields of engineering practice are most closely related to the particular phase of water development and use.

The members of the EJC Water Policy Panel who will have the administrative responsibility for the project are: E. L. Clark, AIME; R. D. Hoak, AIChE; C. W. Mayott, AIEE; W. F. Uhl, ASME; and W. W. Horner, ASCE, chairman.

Until now, serious consideration of the engineers' interest in revision and clarification of water policy appears to have been confined to the Committees of EJC, of ASCE, and of specialized societies such as the American Water Works Association and the National Water Conservation Conference. The present EJC project envisages collaboration by a large number of members of its five national engineering Societies.

EJC has recognized its obligation to arrange for this public service undertaking because of the broad knowledge and experience of the members of the engineering profession in the general matter of water resources development and use. Probably no other group of citizens is so familiar with the pertinent essential facts and with current practice, or is so clearly

aware of the adverse effect of present inconsistent and uncoordinated policies on the national economy. While service on the task force committees, now being organized, will involve personal sacrifice on the part of the members who will serve, the EJC Water Policy Panel anticipates a ready response to service calls. Members of the profession have heretofore been in the position of listing and discussing deficiencies and detriments under present policies and procedures. Here for the first time will be a broad opportunity to present constructive suggestions.

EJC Endorses Proposals for Pan-American Engineering Group

PROPOSALS FOR FORMATION of an inter American engineering organization, made at the first Pan American Engineering Congress in Rio de Janeiro last July, have been unanimously approved by the Committee on International Relations of Engineers Joint Council, according to Malcolm Pirnie, Past President ASCE, chairman of the committee. The committee states that it favors complete cooperation with other engineering societies of the Americas to bring into being the proposed organization of engineering societies in this hemisphere.

This EJC action assures the full participation of engineering societies of the United States, with those of the other American nations, in an organizational meeting to launch such a federation, which will be held in Havana at a date to be announced later. Objectives of such a new organization would include the further advancement of engineering science and practice and development of engineering skills by direct exchanges among the participating societies. Such a group would also foster collaboration among the members of participating societies and other international organizations.

United States engineers and industrialists took part in the first Pan American Engineering Congress by submitting more than 100 papers, and 40 engineers attended the congress.

Welding Research Council Elects New Officers

HARRY C. BOARDMAN, M. ASCE, director of research for the Chicago Bridge & Iron Co., Chicago, was elected chairman of the Welding Research Council at the annual meeting of the organization in New York, succeeding Dr. C. A. Adams, who has been elected to the honorary chairmanship. Dr. A. B. Kinzel was elected vice chairman. Organized in 1935 under sponsorship of the Engineering Foundation, the Welding Research Council has a number of fundamental research projects under way in some 30 universities. ASCE has been a sponsor of the Council since 1946.

Philadelphia Juniors Sponsor Speakers Bureau

A SPEAKERS BUREAU organized by the Junior Forum of the Philadelphia Section for the special purpose of providing speakers for Student Chapter meetings in the Section area is functioning with marked success, according to an announcement from John J. Brennan, Forum secretary. Speakers have recently addressed meetings at the University of Delaware and Drexel Institute of Technology, and early visits to Chapters at the University of Pennsylvania, Villanova, and Swarthmore are scheduled. The talks deal usually with jobs and vocational problems.

In addition to affording members of the Forum valuable practice in public speaking, this cooperative activity of the group does much to strengthen the special bond between students and the younger engineers and to increase interest in the Society and the profession.

Washington Award Goes to Electrical Engineer

WILFRED SYKES, AM. electrical engineer and president of the Inland Steel Co., receives the 1950 Washington Award "for invention of electrical machines and steel processes for advances in industrial administration and cooperation for counsel to state and college."

Joint award of the four Founder Societies and the Western Society of Engineers, the Washington Award is given annually for "accomplishments which preeminently promote the happiness, comfort, and well being of humanity." Presentation of the award to Mr. Sykes was made at a joint dinner meeting of the participating societies at the Furniture Club of America on February 27.

ECPD Publishes Selected Civil Engineering Listings

AVAILABILITY OF A selected bibliography of civil engineering subjects, listing more than 225 titles under eight headings, is announced by Engineers' Council for Professional Development. One of the first sections of the ECPD six-part "Selected Bibliography of Engineering Subjects" to be completely revised and enlarged under the current revision program, the present nine-page pamphlet replaces the civil engineering listing first issued in 1937.

Copies of Section III, Civil Engineering, may be obtained from ECPD, 29 West 39th Street, New York 18, N.Y., at 25 cents. Also available from ECPD at the same price is a ten-page annotated bibliography of aeronautical engineering subjects.

VIEW OF SPEAKERS' TABLE at annual banquet meeting of Pittsburgh Section, at which newly elected ASCE President Ernest E. Howard and Henry J. Sherman, Vice-President, Zone II, were guests of honor, shows (left to right) Wilfred Bauknight, Section vice-president; Mr. Howard; W. F. Trimble, Jr., president of Section; and Mr. Sherman. Mr. Howard spoke on "The Antiquity of the Engineering Profession."

PROCEEDINGS PAPERS
AVAILABLE AS SEPARATES

THE FOLLOWING PAPERS, to be printed as Separates, are now subject to advance orders, based on the summaries here given. Discussion of these papers will be received as in the past. A summary of each paper will appear in three consecutive issues of CIVIL ENGINEERING, and papers will be mailed soon after returns give an indication of the number to be printed. Abstracts of other papers will be added every month to the list of Separates available. Information concerning distribution to members is noted on the mail order coupon (p. 102).

1. **Improvements at the Back River Sewage Works, Baltimore, Md.**, by C. E. Keefer, M. ASCE. Both increase of load and decrease of relative efficiency combined to require expenditures of almost $4,000,000 in improving primary and secondary treatment for the city and its environs. Included in the improvements were screens, grit chambers, settling tanks, activated sludge units, chlorination, digestion tanks, gas holder and vacuum filters. Other accessories, as pumps, pipelines, and power station, helped in this modernization completed in 1947.

2. **Public Utility Condemnation Cases in the State of Washington** by Henry L. Gray, M. ASCE. This simple narration deals with the Washington Public Utility Act and its workings, and particularly the acquisition of a number of privately owned light and power properties through 19 condemnation proceedings, all heard in Courts. Many important data are given, also certain conclusions as to what might be expected to happen in such cases, with suggestions and advice as to engineering procedure in condemnation matters.

3. **Treatment of Foundations of Large Dams by Grouting Methods** by A. W. Simonds, M. ASCE, Fred H. Lippold, M. ASCE, and R. E. Keim, Assoc. M. ASCE. Nowadays large dams require foundation treatment, the success of which is only determined after the structure is in operation. General plans for the successful treatment by pressure grouting as developed in a score of structures completed since 1935 by the Bureau of Reclamation and the TVA, include low-, intermediate-, and high-pressure grouting in specific areas beneath the base. Various grouting materials, methods, and types of equipment are discussed, their advantages and disadvantages being shown under varying conditions and at different locations.

4. **Capillary Phenomena in Cohesionless Soils** by T. William Lambe, Jun. ASCE. Fundamentals of capillarity in cohesionless soils are explained by first describing analogies in capillary tubes and then presenting data from soil tests to substantiate the conclusions. Presently used theoretical methods for computing the rate of flow of water under the influence of capillarity are investigated and evaluated; and improvements are suggested. The paper also discusses the limiting values of capillary head which a cohesionless soil may have; and the role of the different capillary heads in the various types of capillary flow.

5. **Elastic Restraint Equations for Semi-Rigid Connections** by J. E. Lothers, M. ASCE. Most beam-column connections, through the outstanding legs of structural shapes, are styled "semi-rigid framing." Deflection of these legs gives rise to a rigidity intermediate between those of simple and "rigid frame" connections. Recent laboratory measurements in this country and England have disclosed a constant, Z, which is needed for the analysis of such connections. Equations here derived for finding Z for the web-angle type obviate the necessity for expensive laboratory measurements.

6. **Slope Deflection Equations for Curved Members** by Keith T. Fowler, Jun. ASCE. Complex structural frameworks, particularly when under multiple loading conditions, are shown susceptible to simple solutions with few unknowns. "Curved members" include those with a variable moment of inertia. The theory is based on the neutral point concept of the column analogy, and discusses the values added to or subtracted from the fixed-end reactions by changes in the relative positive of the supports. No restriction is placed on the applied loads or joint deflections (including rotations) as long as they lie in the plane of the structure. Three examples, with detailed calculations, illustrate the method. (Available April 1.)

7. **The Geochemistry of Earthwork** by Hyde Forbes, M. ASCE. Geologic and chemical processes account for the kinds and quantities of mineral substances found in earth that has been "worked" in the presence of air and water—for example, those set up in the compaction of earth structures and over earth surfaces in excavation. The most obvious and readily determined physical change is shown to be the production of fine particles and colloidal material from the constituent crystalloid minerals with excavation and working. The resulting mineralogical change is apparent through the comparison of the specific gravity of the mineral particles before and after being worked. (Available April 1.)

8. **Floating Tunnel for Long Water Crossings** by Charles E. Andrew, M. ASCE. A novel and unusual type of floating tube is proposed, to cross Puget Sound from Seattle to the west shore, approximately 14,800 ft. Water depths of between 750 and 800 ft for 10,000 ft preclude any structure on piers. At the center a 50-ft draft clearance is provided between ventilating towers 3,500 ft apart. This four-lane tunnel, involving a self-liquidating bond issue of $60,000,000, will reduce the present ferry cost to less than one-half. An alternate proposal involves floating and suspension bridges at an adjacent site. (Available April 1.)

9. **Atchafalaya River Diversion and its Effect on the Mississippi River** by Leo M. Odom, M. ASCE. These new data and concepts concern one of the greatest river problems of all time. In a century the Atchafalaya has grown from a small bayou to a river discharging 640,000 cfs (1945 flood), to the alarm of many able engineers. More recently its increase has been aided by the Mississippi River Commission as part of the over-all flood control project. Many contentions of opponents to its growth have been unanswered, but this paper apparently refutes the claim that increase in the diversion would cause the Mississippi to lose capacity below that point. (Available April 1.)

10. **Pollution Abatement Policy** by Thomas R. Camp, M. ASCE. Since the objective of pollution abatement is to reclaim watercourse for appropriate uses, control agencies should aim toward maintenance of adequate water quality at least cost rather than wholesale construction of treatment works. They should permit selection of wastes to be treated for greatest overall economy and provide for assessment of costs in proportion to the amount of wastes produced, whether treated or not. Agencies should establish limiting pollution loads allowable at each point of pollution and should re-allocate loads when other riparian owners wish to produce liquid wastes. (Available April 1.)

11. **Long-Term Storage Capacity of Reservoirs** by H. E. Hurst. To enable the Nile to be fully used for irrigation in Egypt and the Sudan, large storage reservoirs in Lake Victoria and Lake Albert will store water over long periods, equalizing the flow of the White Nile even through low years. For determining the storage required to guarantee a given draft, long-term records of many phenomena have been analyzed, including rainfall, river discharges, the annual growth of the big California trees, and the annual deposits of mud in lakes. The analysis brings out the difference between natural phenomena and chance events. (Available May 1.)

12. **Influence Charts for Concrete Pavements** by Gerald Pickett and Gordon K. Ray, Jun. ASCE. Using special charts it is easy to obtain theoretical deflections and stresses within a pavement slab regardless of the distribution of loading. For example, for an airplane landing gear with twin wheels in tandem, the imprint of the tires is drawn on transparent paper to a scale that depends on the slab and its supporting subgrade. The drawing is then placed on the appropriate chart in the proper position and data are taken directly from the area covered. The basis for the charts is given. (Available May 1.)

13. **Reinforced Concrete Skewed Rigid-Frame and Arch Bridges** by Maurice Barron, M. ASCE. This original presentation permits analysis and design that indicate the effect of skew on a barrel arch or rigid frame. Thus the skew problem resolves into a sort of secondary stress analysis, the ordinary stresses for a rectangular structure being considered primary. Then in the final design steel reinforcement and unit stresses are considered as functions of the similar rectangular elements. Equations and transformations are derived

for all applied loads and for volume changes, and a test evaluates the importance of the skew effects. (Available May 1.)

14. Mathematical Analysis of an Aerial Survey by Lo-Ho. In the comparatively brief time since geodetic engineers and surveyors have taken to the air for blanket solutions of their problems, the explorers in this field have become identified in two categories—those who like to reduce their "notes" by instruments (stereometric topographic mapping) and those who place a greater reliance and emphasis on analytical analysis (analytical photogrammetry). Professor Lo-Ho stakes his claim in the latter field, and offers for discussion a procedure for the application of least squares to the successive correction of observations resulting from his system of aerial triangulation. A special feature of the paper is the author's statement of condition equations using the direction-cosine principles of space geometry. (Available May 1.)

15. Computation of Equitable Charges for Treatment of Municipal Sewage by Ellis E. Bankson, M. ASCE. It is hoped that, by discussion of this paper, a sound basis may be established for adopting rate schedules for sewage service. Such a schedule should include the special and unique cost features of ground-water infiltration (which are about equal to the cost of domestic flow, at nearly 30 gal per capita per day). Provision for daily peak flow produces a spread of equitable charges, in this case, from 18 cents per thousand gal to 7 cents per thousand gal. Modern needs of high specialization take into account a difference between frugal and unrestricted home use, as well as the difference between the use recorded by individual water meters and a master meter for a housing project. (Available May 1.)

D-VII Discussion of Paper, **Deflection of Plywood Beams Due to Moisture Content Change**, by W. E. Wilson and Laurence G. Olson. The original paper, published in the April 1949 PROCEEDINGS (p. 429), explores the reasons for the deformation of long floor panels of plywood box girder construction. M. W. Jackson, assistant professor of civil engineering at Georgia Institute of Technology, has discussed the internal stresses in a piece of plywood subject to variations in moisture content, and the authors have closed the discussion with a brief reply to Professor Jackson. These discussions only are included in Separate D-VII, to supplement the main paper. (Available May 1.)

Order coupon on page 102.

TOTAL MEMBERSHIP AS OF FEBRUARY 9, 1950

Members	7,514
Associate Members	9,667
Corporate Members	17,181
Honorary Members	39
Juniors	10,810
Affiliates	74
Fellows	1
Total	28,105
(February 9, 1949	25,041)

FROM THE NATION'S *Capital*

JOSEPH H. EHLERS, M. ASCE
Field Representative, ASCE

SINCE THIS IS an election year, much Congressional legislation will be considered from the viewpoint of voter appeal and much will be passed over. Only a moderate amount of action can be expected on matters dealing with the engineer in his professional work, although many matters of interest to him as a citizen will be considered.

No serious danger to the professional provisions of the Taft Hartley Act is expected this session.

The President's Point IV program to aid underdeveloped areas of the world has been brought up to date with the introduction of several new bills, H.R. 6834, H.R. 6835, and S. 2917. H.R. 6834, which contains compromises to cover points brought out by opponents, has recently been approved by the House Foreign Affairs Committee.

The National Science Foundation legislation, as has often been reported, is still held up in the House Rules Committee. Some opposition has been voiced by economy-minded members. This legislation would probably effect sufficiently important economies in the nation's research work to repay its cost in a short time. The Rules Committee may clear the legislation or an effort may be made to bypass the Rules Committee by those who feel such legislation is urgently needed.

D.C. Engineers' Registration Bill Reintroduced

The D.C. Engineers' Registration Bill, H.R. 1188, is a local issue that has taken on some aspects of a national matter—first because it affects the nation's capital and second because the District of Columbia is the only part of continental United States without a registration law for engineers. This bill has introduced by Congressman Carl Hinshaw, M. ASCE.

At hearings in February, representatives of the operating engineers expressed concern over provisions which might bar them from doing work they customarily perform. It is expected that this point and some possible questions on the composition of the Board of Registration will be cleared up. The D.C. Council of Engineering and Architectural Societies, with which the District of Columbia Section of ASCE is affiliated, is handling this matter on a sound basis and has resisted efforts to push through a poor bill to facilitate its passage. ASCE has supported the measure and efforts of the Council at both national and local levels.

Central Arizona Project Passes Senate

Another extremely controversial issue is the Central Arizona Water Project, S. 75, which has passed the Senate by a vote of 55 to 28. The bill goes to the House, which has a similar measure in the Public Lands Committee.

Hearings will be held in the near future on H.R. 3224, a bill designed to equalize taxation on earned income of engineers and other professional workers. Basically, the proposal provides for excluding from taxable income in a year of high earnings certain amounts expended for the purchase of proposed government bonds. The effect would be to make the income taxable when the bonds are redeemed.

An Engineers Joint Council panel is reviewing the proposal under the chairmanship of the ASCE member and in cooperation with bar associations and the American Institute of Architects. A statement will be presented at the forthcoming hearings.

Recommendations of Hoover Commission

Senator Cain has introduced a bill, S. 2833, which would put into effect the Hoover Commission recommendations concerning the functions and organization of the Interior Department. This bill would abolish various bureaus now in the Interior Department, such as the Bureau of Reclamation and the Southwestern Power Administration and transfer their functions directly to the office of the Secretary. It would transfer the important river and harbor work of the Corps of Engineers to the Secretary of the Interior. Various construction functions now performed in the General Services Administration would also be transferred. Owing to the controversial nature of the proposal, with ASCE members employed in all of the affected bureaus, the Board of Direction of the Society has taken a neutral stand on the matter. Similarly, Engineers Joint Council will take no stand. It seems doubtful whether this bill in its present drastic form can pass this session.

Hearings are currently under way on H.R. 6257 a bill to provide further water resources basic data by the Geological Survey and the Weather Bureau. This matter is related to National Water Policy, which is under study by an Engineers Joint Council committee.

Washington, D.C.
February 21, 1950

Coming Local Section Events

Buffalo—Meeting at the Buffalo Athletic Club, Buffalo, March 21.

Central Ohio—Joint meeting with the Columbus Technical Council at the Chittenden Hotel, Columbus, March 20, at 6:15 p.m.

Cleveland—Dinner meeting at the Cleveland Engineering Society, Cleveland, March 17; dinner at 6:30 p.m. and meeting at 8 p.m.

Colorado—Dinner meeting the second Monday of every month at 6:30 p.m.; technical meeting at 8 p.m. Section luncheons every Wednesday at Daniels & Fishers Department Store at 12 noon. The Soil Mechanics and Foundations, Hydraulics, Structural, and Irrigation Divisions of the Section meet monthly on the first Monday, the first Tuesday, the third Thursday, and the fourth Monday, respectively.

District of Columbia—Meeting in the Cosmos Club Auditorium, Washington, D.C., March 14, at 8 p.m.

Ithaca—Dinner meeting at the Ithaca-Terrace Room, Ithaca, March 22, at 8 p.m.

Kansas—Meeting in Topeka on March 31.

Metropolitan—Meeting in the Engineering Societies Building, New York City, March 15, at 8 p.m.

Mid-South—Dinner meeting of the Jackson Branch of the Section at the Hotel Heidelberg, Jackson, Miss., March 29, at 6:30 p.m.

Northeastern—Dinner meeting at Northeastern University, Boston, Mass., March 20, at 6 p.m.

Philadelphia—Meeting in the Engineers' Club, Philadelphia, March 14, at 7:30 p.m.; preceded by dinner at 6 p.m.

Sacramento—Regular luncheon meetings every Tuesday at the Elks Club, Sacramento, at 12:30 p.m.

San Francisco—Weekly luncheons every Wednesday at the Engineers Club of San Francisco.

Tacoma—The Tacoma Section will be host to the Pacific Northwest Conference, which will be held at the Winthrop Hotel, Tacoma, Wash., May 5 and 6.

Scheduled ASCE Meetings

SPRING MEETING

Los Angeles, Calif., April 26–29
(Board of Direction meets April 24–25)

ANNUAL CONVENTION

Toronto, Canada, July 12–14
(Board of Direction meets July 10–11)

FALL MEETING

Chicago, Ill., October 11–13
(Board of Direction meets October 9–10)

WEST VIRGINIA SECTION OFFICERS are, left to right, J. N. Wallace, past-president; R. C. Quinn, vice-president; F. D. McEnteer, president; and K. A. Kettle, secretary-treasurer.

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Akron	Jan. 12		Annual business meeting with election of officers, M. P. Lauer presiding.
	Jan. 27	30	Dinner meeting with ASCE President Ernest E. Howard talking on Society activities.
Buffalo	Jan. 31	70	Col. Frank H. Forney, district engineer, Buffalo District, Corps of Engineers, discussed port development and port authorities.
Central Ohio	Jan. 26	53	C. D. Bowser reported on activities of District 9 Council constitution committee. President Ernest E. Howard explained changes in Society publications and proposed constitution changes. Leo R. Yeager, of Owens Corning Glass Co., outlined history of fiber glass.
Colorado	Jan. 9	61	R. F. Blanks, of U.S. Bureau of Reclamation, Denver, described formation of Student Loan Fund as memorial to Jacob E. Warnock. Past-President Franklin Thomas discussed Society activities.
Connecticut	Dec. 13	121	Joint meeting with University of Connecticut Student Chapter. C. S. Farnham, of New Haven, commented on work of State Highway Department, and Carleton F. Sharpe, city manager of Hartford, emphasized close relationship between city manager and city engineer.
Florida Gainesville Sub-Section	Jan. 26	29	C. D. Williams, president of Section, gave resumé of ASCE Annual Meeting, and D. A. Firmage, assistant professor of structural engineering, University of Florida, lectured on history of bridges.
Iowa	Jan. 12	136	Joint meeting with the Iowa State College Student Chapter. Prof. Franklin Thomas, Past-President of ASCE, spoke on professional problems, with special reference to students and Juniors.
	Jan. 25	25	Dinner meeting. Prof. F. B. Farquharson, director of Engineering Experiment Station, University of Washington, gave an illustrated talk on studies of the Tacoma Narrows Bridge.
Kansas City	Jan. 24	103	Dinner meeting. Speakers included Arthur Gilbert, director of research and curriculum of the Kansas City Public Schools, on school financing; and Robert M. Hoover, president of the Kansas City Bridge Co., on taxation policies.
	Jan. 24	103	Robert M. Hoover, president of Kansas City Bridge Co., talked on free enterprise.
Los Angeles	Dec. 2		Annual Ladies' Night Dinner Dance.
	Jan. 11	118	Joint meeting with student chapters of California Institute of Technology and University of Southern California, featuring student

			paper competition. Dr. J. Eugene Harley, department of political science, USC, spoke on the United Nations.
Maryland	Jan. 11	104	Dr. George S. Benton, assistant professor, department of civil engineering, Johns Hopkins University, discussed "Engineering Applications in Meteorology."
Miami	Jan. 5	22	Dinner and business meeting. Forrest D. Banning spoke on the atomic bomb and revision of building codes.
Mid South Jackson Branch	Jan. 25		Dinner meeting. Election of officers. W. J. Turnbull, chief of Soils Division of the Waterways Experiment Station, Vicksburg, discussed tying in Mississippi property lines with the U. S. Coast & Geodetic Survey.
Mohawk Hudson	Dec. 15		Business meeting with election of officers. Student paper competition with R. C. Hirschfeld of Union College the winner with paper on "Artificial Recharge of Groundwater Reservoirs." Award of certificates of life membership.
Montana	Dec. 9	18	Discussion of proposed Section constitution and by-laws. H. R. Foote, chief of Sanitary Engineering Division, Montana State Board of Health, talked on stream pollution.
North Carolina	Jan. 14		Annual meeting with installation of officers. Speakers included R. E. Fadum, head of North Carolina State College Civil Engineering Department, on relating opportunities for research in civil engineering, and Charles R. McCullough, professor of civil engineering, NCSC, on interpreting land forms and soil types from the air. Life membership certificates were awarded.
Northwestern	Jan. 9	77	Lee Turzillo, vice president of Intrusion Prepakt Corp., Cleveland, Ohio, and John C. King, Sr., chief engineer, talked on the use of Prepakt concrete.
Philadelphia	Jan. 10		Walter C. Boyer, assistant professor, Johns Hopkins University, spoke on development of design of reinforced concrete, and Thomas F. Comber, head of department of civil engineering, led discussion.
Delaware Sub-Section			Homer Seely, project engineer, Delaware River Memorial Bridge, discussed construction problems on the project.
Pittsburgh	Dec. 15	60	Juniors' meeting with panel discussion on fabrication of structural steel by Stanley F. Book, J. M. Scott, and Malcolm D. Corner, all employed by American Bridge Co.
	Jan. 14	45	Juniors' inspection tour of Phillips Power Station.
Puerto Rico	Jan. 20	18	Business meeting.
San Diego	Jan. 24	89	Annual Ladies' Night Meeting. Life membership certificates presented.
Seattle	Dec. 28	53	Prof. Stuart W. Chapman, director, division of humanistic-social studies, University of Washington, spoke on the engineer as a man. Life membership certificates were presented, and new officers installed.
Spokane	Dec. 9		Annual meeting with election of officers. Section's Board of Direction voted to increase dues from $1 to $3 a year, which was ratified by members present.
St. Louis	Jan. 23	80	Annual meeting with election of officers. Ray Tucker, chairman of Board of Freeholders of City of St. Louis, discussed proposed city charter, particularly sections affecting the status of professional engineers.
Tri-City	Jan. 18	40	Dinner meeting featuring talk by F. P. Funda, division engineer, Chicago, Rock Island & Pacific Railroad Co., on new hump in Silvis.
Virginia	Feb. 10	100	Annual meeting with installation of officers. Speaker was Director Paul L. Holland, director of Public Works, Baltimore, Md. Life membership certificates were presented.
Wyoming	Feb. 23		Dinner meeting.

University of Puerto Rico Installs Student Chapter

More than 75 civil engineering students at the University of Puerto Rico and a large delegation of ASCE members joined in celebrating the installation of a new ASCE Student Chapter at Mayaguez, P. R., on February 10. Designated, the University of Puerto Rico Student Chapter, the group will have headquarters at the College of Agriculture and Mechanic Arts, which is the part of the university located in Mayaguez. With strong support of the Puerto Rico Section a promising future for the new Chapter is assured. Considerable credit for organization of the group is due Prof. Franklin O. Rose, who is head of the department of general engineering at the university and has been appointed the first Faculty Adviser of the Chapter.

The installation ceremony included presentation of a diploma of certification and the award of membership cards in the Chapter to charter members. In presenting the diplomas, ASCE Executive Secretary William N. Carey detailed characteristics required of the engineer by his profession. Measuring the compensations for a life of service in engineering, he said, "The knowledge that he has helped to make life better for his fellows is the heart-warming satisfaction that few but engineers are privileged to enjoy. That satisfaction is the real reward in the lives of men who follow the calling of civil engineering." Continuing firm support of the Puerto Rico Section was pledged by President Paul Arroyo and by Ramon Gelabert, Chapter Contact Member. Mr. Gelabert outlined specific activities in the program of Section-Chapter cooperation. The privileges and responsibilities of the students themselves, as they accepted membership in the new Chapter were described by Don P. Reynolds, Assistant to the Secretary of ASCE. Each new Chapter member received his card with the personal congratulations of the Commissioner of the Interior Jorge J. Jimenez, who told the group of the vast opportunities for civil engineers in the development of Puerto Rico. Presiding was Jorge Juncos, Chapter president. The university was represented by Chancellor Benitez and Vice-Chancellor Stefani.

The Puerto Rico Section held a special meeting at Mayaguez, following installation of the Chapter and a joint luncheon of the two groups. The technical program consisted of discussion of the extensive Southwestern Puerto Rico Project by Pedro Colon Pagan, principal construction engineer for the Puerto Rico Resources Authority.

Establishment of the Chapter at Mayaguez brings to 128 the total number of ASCE Student Chapters.

NEWS BRIEFS

Former President Hoover and R. E. Dougherty Honored by Moles for Public Service

PRAISING ENGINEERS FOR their early realization of the fact "that the way to lift the standard of living is to eliminate waste and otherwise reduce the cost of production," former President Herbert Hoover, Hon. M. ASCE, said in accepting the Moles' 1950 non-member award at the tenth annual dinner of the organization, held at the Waldorf-Astoria in New York on February 9, that economists, lawmakers, and politicians have lagged behind the profession in recognition of these facts. The member award of the Moles, New York society of heavy construction men, went to ASCE Past-President Richard E. Dougherty. In the same ceremonies, Gen. Dwight D. Eisenhower, president of Columbia University, was made an honorary member of the organization.

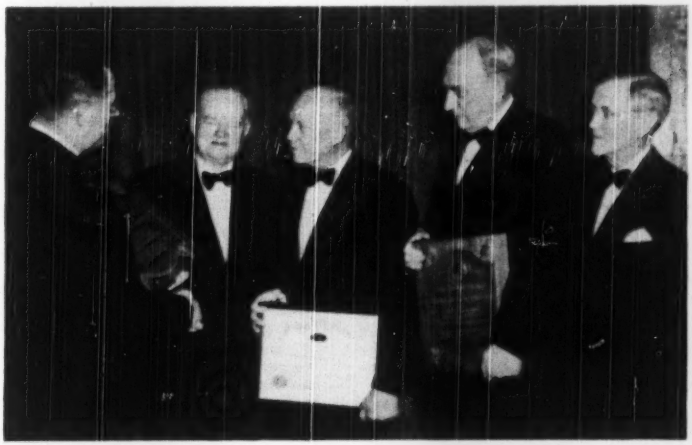
Mr. Hoover emphasized the "great satisfactions" the engineer can feel in his work, despite its vicissitudes. The figments of his imagination, he said, coming "to realization in stone or metal or energy can bring jobs and homes to men." He received his award from Carlton S. Proctor, M. ASCE, president of the Moles, who praised the former President's long career in public service, particularly his recent chairmanship of the Commission on Organization of the Executive Branch of the Government. Mr. Hoover was cited for "his superlative leadership in advancing human dignity, individual enterprise, and personal freedom; the foundations of a better world."

In accepting his award, Mr. Dougherty recalled some of his difficult engineering jobs as chief engineer of the New York Central. He gave high praise to engineers working underground or under water. Though their work is frequently unheralded and unsung, he said, "nevertheless, they can have the satisfaction of bearing the recognized responsibility for one of the great fundamental and basic operations of the heavy construction industry."

Mr. Dougherty was honored for his 46 years of important work with the New York Central and for his leadership in the profession. His citation referred, in part, to "his engineering leadership and his tireless and unselfish service in promoting public safety, in advancing transportation standards, and in urban planning and development."

General Eisenhower, who made the guest speech, stated that he favored the manufacture of the hydrogen bomb by the United States, declaring that to do otherwise would be to bury our heads in the sand. "I can't go along with those who believe we should hide the horror of the H-bomb in ignorance," he said. "I can see no good in ignorance. From the beginning of time, every invention of mankind has been capable of two uses, good and evil. It is up to the moral fiber of mankind to decide to which use an invention is put."

Established in 1941, the Moles awards have been won by a distinguished list of engineers including Lt. Gen. Brehon Somervell, Rear Admiral Ben Moreell, and the late Frank Crowe, Honorary Members ASCE, and Miles L. Killmer, M. ASCE.



CARLTON S. PROCTOR (LEFT), PRESIDENT OF MOLES, chats with honor guests of organization at recent annual dinner. With him, left to right, are former President Hoover, General Eisenhower, Mr. Dougherty, and W. A. Durkin, veteran New York contractor and member of Moles. Mr. Durkin presented Mr. Dougherty's award to him.

Cleveland to Have New Rapid Transit System

RECENT AWARD OF a contract was made by the Cleveland Transit Board to the Chicago consulting firm of DeLeuw, Cather & Co. for preparing plans and supervising construction of a new $16,000,000 rapid transit system for the city. Financing has been arranged through a loan of $22,000,000 from the Reconstruction Finance Corp., the difference to be used for new equipment, shops, and other capital improvement.

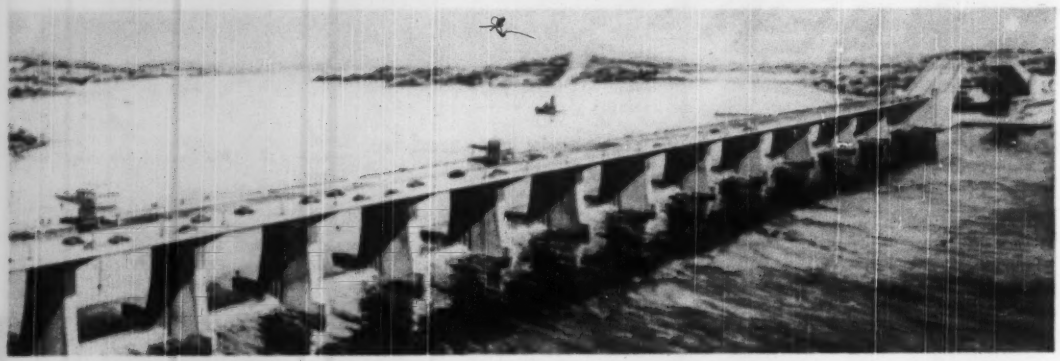
Modernization of the rapid-transit system, along lines suggested by DeLeuw, Cather & Co. in an earlier report, will involve construction of a double-track line along the rights-of-way of the Nickel Plate and New York Central railroads for a distance of about 12 miles. Downtown delivery of rapid-transit passengers will be made at the Cleveland Union Terminal, which was constructed initially with provision for such service, and a new pedestrian tunnel will be built between the Union Terminal Building and the public square. Under the contract, plans will be prepared for track work, signals, power distribution, stations, and bus-to-rapid-transit passenger interchange facilities. Terminals and yards for new rolling stock will also be designed.

Work to Get Under Way on New Jersey Turnpike

WITH THE RECENT signature of Governor Driscoll to two bills amending the New Jersey Turnpike Authority, construction will start at once on the state's 118-mile superhighway, according to an announcement from Paul L. Troast, chairman of the Authority. The amendments have to do with the financing of the project and with the acquisition of land for its right-of-way.

Extending from a point near the George Washington Bridge in the north to Deepwater, N. J., in the south, where it will connect with the Delaware Memorial Bridge now under construction, the new turnpike will be one of the safest and most modern all-weather highways ever built, according to Mr. Troast. Present schedules call for completing the project in November 1951.

Hudson River Dam Proposed as Solution to New York Water Problem



CONSTRUCTION OF HUDSON RIVER DAM is proposed to New York Board of Water Supply for study and evaluation by Citizens Budget Commission, Inc., as permanent solution for New York's water supply problem. Proposed regulating dam below Poughkeepsie near Chelsea would prevent entry of salt water into pump intake and treatment plant at emergency pumping plant into Delaware Aqueduct at Shaft 6, described on this page. Proponents assert that navigation channel depth will be increased about 6 ft above dam and that river traffic can be handled readily through two locks (one shown at right of sketch). Dam could also provide highway crossing. Engineers for the Budget Commission—Lawrence T. Beck and Dean G. Edwards, both ASCE members—estimate cost of project at $200,000,000, or about half that of further development of the Delaware River Basin (Incodel plan).

Bids Received on Emergency Hudson River Water Supply

BIDS FOR DESIGN and construction of the installations needed to utilize Hudson River water in relieving the current shortage in New York City were opened by the Board of Water Supply on February 20. Installations covered in the contract include an electrically operated or direct-connected, diesel-operated pumping plant capable of pumping 100 mgd of water from the Hudson into the Delaware Aqueduct against a 600-ft head; a chlorinating plant for sterilizing the pumped water before it enters the aqueduct; buildings suitable for housing both plants; and operation of the plants for a period not in excess of four months following their completion. All installations will be located near Chelsea in Dutchess County, New York.

With completion of the plant in seven or eight months, the city will be able to pump Hudson River water into the Delaware Aqueduct at Shaft 6 and from there into its water-supply system. Before entering the aqueduct the water will be treated by superchlorination. In the aqueduct it will be mixed with water flowing toward the city from the Rondout supply. The Hudson River water will be further diluted in the West Branch, Kensico, and Hill View reservoirs by mixture with waters from the city's upland sources. If necessary, the mixed water will be treated again before leaving the reservoirs.

Three low bidders were announced as the Baltimore Contractors, Inc., of Baltimore, Md., and McCollum & Murphy, of Islip, L. I., bidding jointly $2,387,000 on the electric job and $3,018,000 for the diesel installation; Spencer, White & Prentis, of New York City, $2,476,000 and $3,067,000; and the Fuller Construction Co., and A. J. Dillenbeck, both of Red Bank, N. J., bidding jointly $2,684,000 on the electric work only. The successful bidder will be required to begin work ten days after award of the contract, and the work is to be completed within eight months.

The city is also considering possibilities of relieving the water shortage by scientific rain-making, and has hired Dr. Wallace E. Howell, research meteorologist at the Blue Hill Meteorological Observatory, Harvard University, to make a preliminary study of the situation.

The project will be conducted under the direction of I. V. A. Huie, M. ASCE, president of the New York Board of Water Supply.

Power Production Begun at Allatoona Project

PRODUCTION OF HYDROELECTRIC power at Allatoona Dam, Corps of Engineers project on the Etowah River in Georgia, was initiated on February 1, according to an announcement from Maj. Gen. Lewis A. Pick, chief of engineers. The 36,000-kw unit, together with a similar unit scheduled to go into production in April, will yield an energy output of approximately 169,000,000 kw a year, enough to serve 140,000 homes on the basis of the national average of consumption.

A concrete structure, 1,250 ft long and rising 190 ft above the river bed, Allatoona Dam is the initial project in a comprehensive plan for development of the Alabama-Coosa River system and the sixth multipurpose Corps of Engineers project producing hydroelectric power as a secondary benefit.

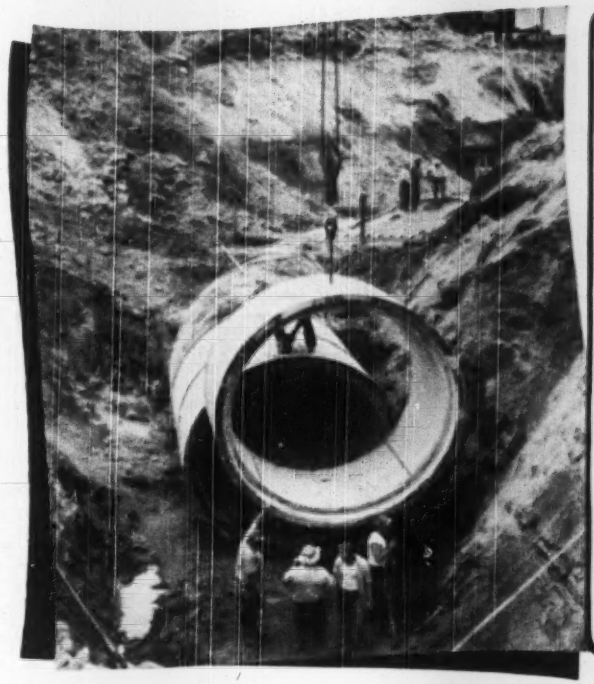
Florida Reports Progress In Abating Stream Pollution

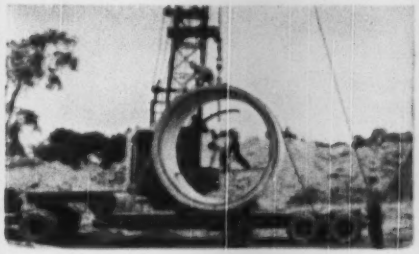
PROGRESS IN REDUCING stream pollution in Florida is reported in a summary of accomplishments for the past three years in the field, compiled by the State Board of Health, of which David B. Lee, M. ASCE, is chief sanitary engineer.

The report, entitled "Florida Moves Forward in Pollution Abatement," lists 108 waste-disposal projects that have been approved by the state health agency in the past three years. These plants represent an estimated construction cost of more than $35,000,000. Of approved projects, 77 have either been built or are under construction at a total cost of $23,000,000. The report also notes completion of 23 small industrial waste treatment plants and 35 septic tanks or sand filters for schools, night clubs, trailer and tourist parks, and other areas where municipal sewage disposal is not available.

El Paso, Tex., Establishes Department of Planning

CREATION OF A Department of Planning in El Paso, Tex., was recently announced by Mayor D. L. P. Duke. Establishment of the new department was unanimously approved by the city council in a move to insure better consideration of municipal problems by separating planning and engineering functions. Planning activities will be supervised by Walter E. Stockwell, since 1923 city plan engineer. Assisting him will be V. L. Mike Mahoney, Jun. ASCE, as associate planner, and William S. Bonner as senior planning analyst.





Above: general view of pipe casting yard. Below: pipe being unloaded at job site. Left: lowering six-ft. section of 120-in. concrete pipe sewer into a 30-ft. open trench.

Midland, Mich., solves storm drainage problem with 120-in. *CONCRETE PIPE*

DURING RAINY seasons Midland, Mich., suffered from acute surface flooding conditions. To end this nuisance residents voted a bond issue for the installation of an extensive storm sewer system.

This storm sewer required 5,080 ft. of 120-in. concrete pipe for the main outfall section and 30,853 ft. of 12-in. to 84-in. concrete pipe for the storm water collecting mains. The 120-in. pipe was cast in six-foot sections each weighing more than 14 tons. This giant pipe was placed in open cuts often 30 feet deep.

Use of large-diameter concrete pipe like this is economical because it is practical to erect a temporary pipe-making plant near the project. Such job-site production: (1) Reduces transportation and handling costs. (2) Eliminates construction shutdowns that result when pipe shipments are delayed in transit.

Like Midland, hundreds of other cities are using concrete pipe for sewers of all kinds because:

- Concrete pipe sewer lines have the strength to resist severe impact and to sustain heavy overburdens to which they may be subjected.
- Concrete pipe's smooth interior finish resists abrasion and provides maximum hydraulic capacity year after year.
- Concrete pipe is moderate in first cost, has the durability to render long years of service with little upkeep expense. These advantages result in true ***low-annual-cost*** sewer service.

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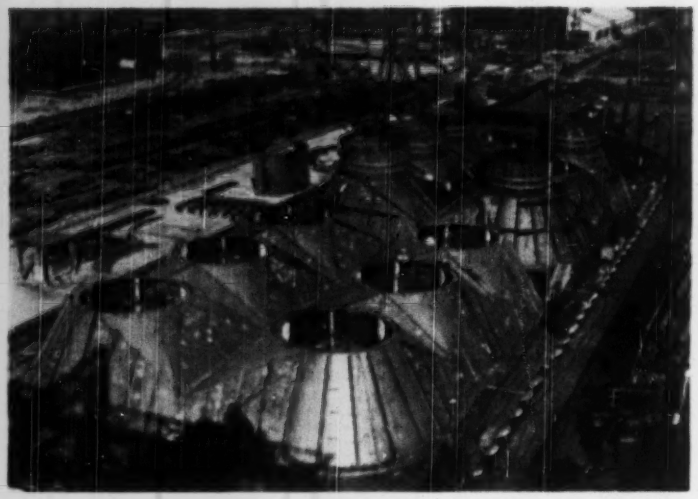
Huge Steel Caissons to Be Floated to Bridge Site at Yorktown, Va.



IN NEWPORT NEWS SHIPYARD work is well under way on six mammoth steel shells, which will be used as permanent forms to support six river piers on 3,750-ft George P. Coleman Memorial Bridge across York River at Yorktown, Va. Pictured are bases of two of the caissons, measuring 52 by 66 ft. When completed sometime this spring, the caissons will be floated through Hampton Roads into Chesapeake Bay and up to construction site on York River. They will be 110 ft in height and will support concrete cylindrical piers 90 ft high. Linking the Virginia Peninsula with the upper Tidewater country of the state, structure will be the largest ever built by Virginia Highway Department. Massman Construction Co. and Kansas City Bridge Co., both of Kansas City, Mo., hold $4,690,232 contract for building substructure, and Virginia Bridge Co., of Roanoke, will build superstructure and bridge decking under $2,242,711 contract. Engineers on project are Parsons, Brinckerhoff, Hall & Macdonald, of New York City. Work is ahead of schedule, which calls for completion early in 1952.

Rich Iron Ore Deposits Found in Venezuela

THE LARGEST AND richest iron ore deposit in history has been discovered in Venezuela by the U. S. Steel Corp., according to a detailed article in the February issue of *Mining Engineering*, publication of the AIMME. Terminating an intensive five year search for foreign ore to supplement dwindling deposits in this country, U. S. Steel geologists first noticed the extremely rich lode of iron ore in April 1947, while aerial photographing the area south of the Orinoco River and west of the Caroni, a tributary of the Orinoco.

The mountain of ore, Cerro Bolivar, rises 2,000 ft from a surrounding area of flat grasslands. Diamond drill holes in the lode show iron ore of almost theoretical maximum purity to a depth of 148 ft. Ore will be quarried from the top of Cerro Bolivar and dropped onto a 4-ft conveyor over 2 miles long, which will carry it from the 2,000-ft level to railroad cars at a 1,000-ft level. The belt will generate enough electric current for the new townsite and all the operating facilities in the area.

With the current goal of bringing out 10,000,000 tons annually by late 1953, U. S. Steel is speeding up plans to open up the Cerro Bolivar area. Later operations will be stepped up to an annual production of 15,000,000 tons. Ocean shipment of ore will be to the ports of Birmingham, Baltimore, and Trenton, N. J. Total U. S. Steel investment costs in Venezuela, including the huge ocean ore carriers required, will approximate $400,000,000.

A decision as to the best route for transporting the ore out of the country will soon be reached. Shipment via the Orinoco River will require dredging of 40,000,000 cu yd of river bottom to open a channel 170 miles upstream to a rail-loading terminal at the confluence of the Orinoco and Caroni rivers, some 91 miles by rail from Cerro Bolivar. The alternative is construction of a 274-mile, $100,000,000 railroad across country from Cerro Bolivar to deep tidewater at Puerto de la Cruz, near Barcelona, which will pass through active oil and gas fields. The latter project will involve construction of a 4½-mile bridge across the Orinoco near the town of Ciudad Bolivar. For the ocean hauls to United States ports, plans are under way for construction of giant ocean ore carriers of about 45,000-ton capacity. As a basis for comparison, the largest Great Lakes ore carriers have a capacity of 18,000 tons.

According to the article, the availability of Venezuelan ore comes at an exceptionally opportune time, when the serious depletion of natural ores in the Lake Superior region is forcing the entire steel industry into tremendous capital expenditure to develop concentration plants for grinding and separating the low-grade taconite ores in the Superior region. The famous rich Lake Superior direct-shipping ores are said to face exhaustion between 1965 and 1970 at the present rate of consumption. If a minimum military reserve of open-pit ore is to be maintained there, the current development of low-grade ore must soon be greatly accelerated. This will demand tremendous capital expenditures over and above the usual rebuilding of production equipment and involve a program paralleling in scope the wartime development of synthetic rubber.

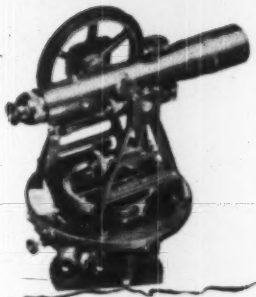
It is expected that, by mid-1960, steel companies other than U. S. Steel and Bethlehem, will be basing their production on 10,000,000 tons of ore received annually from Labrador, 17,000,000 tons of taconite concentrates, 500,000 tons from Liberia, and 4,000,000 tons of Venezuelan ore. This program will involve new investment of well over $600,000,000, exclusive of the lake vessels required for Labrador ore. The drain on Lake Superior natural ores will be practically stopped by then.

N.Y.C. Lets Contract for Brooklyn Bridge Repair

WITH THE RECENT award of a $3,317,536 contract for the Brooklyn Bridge project to the J. K. Welding Co., of Brooklyn, work on reconstructing the center spans and roadways will get under way shortly, according to an announcement by Frederick H. Zurmuhlen, M. ASCE, public works commissioner. The contract price is $617,536 more than the $2,700,000 originally authorized for the work. According to Commissioner Zurmuhlen, indications are that the ultimate cost of the entire improvement project will be $7,125,000 instead of the $5,419,000 estimated for the work in 1948. This increase is attributed largely to the rise in the price of structural steel.

Modernization of the 67-year-old structure will involve conversion from a two-lane thoroughfare into a six-lane modern concrete highway, removal of all trolley tracks from the bridge, and elimination of two of the present six stiffening trusses. The completed project will increase the capacity of the bridge from 23,000 cars a day to 6,000 an hour.

Construction of underground approaches to the Manhattan terminus of the bridge and synchronization of the Brooklyn approaches with the new Civic Center plans will also expedite the movement of traffic. D. B. Steinman, M. ASCE, consulting engineer of New York, who planned reconstruction of the center spans and roadways, will be in charge of engineering plans for the approaches.



WHAT A LEADING TECHNICAL EDITOR WROTE ABOUT ALUMINUM TRANSITS AFTER ANALYZING HOW GURLEY MAKES THEM

Reproduced from a full-length article in the December 1949 issue of MATERIALS & METHODS, written by H. R. Clauser, its Associate Editor. We will gladly send you reprints of the entire article on request.

Aluminum Used Successfully in Precision Instruments

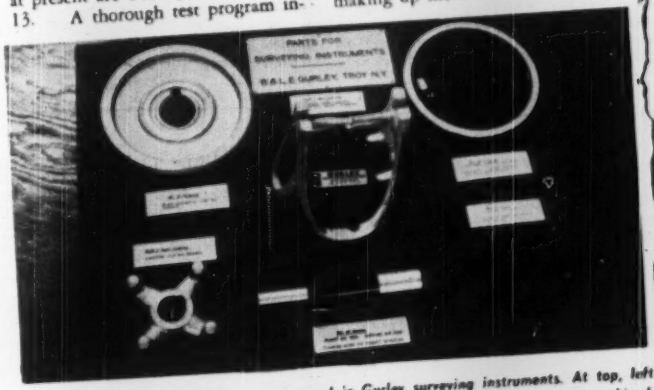
A PICTORIAL STORY

Requirements of accuracy during a long service life are controlling factors in selection of materials for engineering and surveying instruments.

• IN THE MANUFACTURE of precision instruments, the selection and careful processing of materials is of prime importance. Accuracy as well as long service life with a minimum of adjustment and repair are the quality standards that must be met, and to meet them, astute materials engineering coupled with expert workmanship are required. Perhaps no better example of the combination of these two factors can be found than at W. & L. E. Gurley, Troy, N. Y., where precision instruments are produced not only for engineering and surveying, but also for other fields such as meteorology and aeronautics.

Copper alloys and aluminum alloys are the principal materials used in the company's surveying instruments. One of the earliest uses of aluminum in this country was in a Gurley transit 73 years ago. And since that early application, aluminum has proved satisfactory in an increasing number of instrument parts. The main reasons for adopting the use of aluminum were: (1) light weight; (2) relatively high strength and yield point; (3) lends itself to precision machining; (4) good ductility; (5) relatively good corrosion resistance, especially in sulfur atmospheres; and (6) does not distort nor "grow" with age. The aluminum alloys most used at present are 14SW, 61ST, 356 and 13. A thorough test program insures against any differences in accuracy within a temperature range of —80 F and +165 F.

The accompanying pictures illustrate a number of the steps involved in the production of various parts making up the transit.



1—Shown here are the aluminum parts used in Gurley surveying instruments. At top, left and right is a 14SW forging for a horizontal transit limb before and after being machined, anodized and dyed. In the center is a sand casting of 356 alloy for the truss standard. Lower row, left to right, is a transit leveling head sand casting of 13 alloy, a swaged and spun tubing for telescope focusing slide of 51ST alloy, and a graduated vertical circle made of 61ST aluminum sheet which has been anodized and dyed.

You're So Right, Mr. Editor—

The first Gurley Aluminum Transit, built in 1876, was finally retired after 50 years of active service—and then for sentimental reasons only. It met every field "requirement of accuracy during a long service life"—as every Gurley Transit continues to do all over the world.

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Early Registration Urged for Large Dams Congress

ENGINEERS IN THE 23 member countries of the International Commission on Large Dams, who are planning to attend the Fourth International Congress on Large Dams in New Delhi, India, January 10–15, 1951, are asked by the Indian National Committee to make application to their national committees before April 1, 1950. These applications will be forwarded to the National Committee in India and to the Permanent Central Bureau of the International Commission in Paris. Engineers in this country may communicate with the United States Committee on Large Dams, through its chairman, Gail A. Hathaway, M. ASCE, 4316 Van Buren Street, University Park, Hyattsville, Md.

The Fourth International Congress on Large Dams, which will be held simultaneously with a Sectional Meeting of the World Power Conference, will be devoted to study and discussion of four questions covering numerous phases of dam design and construction. The purpose of the World Power Conference will be to consider how the sources of heat and power may be adjusted nationally and internationally. At the close of the joint program there will be a 15-day tour of existing dams, irrigation and hydroelectric works, multiple-purpose projects under construction, research stations, and industrial centers. The tour will end on February 1 at Bangalore, where the closing session of the conference will be held.

Individual membership registration will be $33, of which $22 will be retained by the Indian National Committee, and $11 forwarded to the Permanent Central Bureau in Paris. Cost of the study tour is provisionally estimated at $170 for each participant. Before the Congress starts, delegates from member countries will receive one set of the individual reports and communications free of charge.

Established in 1928, the International Commission on Large Dams promotes research and assembles data on technical problems connected with the design, construction, maintenance, and operation of large dams. The third congress took place in Stockholm in 1948.

Hydroelectric Construction Continues Active in Canada

THE POSTWAR BOOM in hydroelectric development in Canada continued without abatement in 1949, according to the annual review of water-power development and hydroelectric distribution issued by the Dominion Water and Power Bureau of the Canadian Department of Mines and Resources. Though no large plants were brought into initial operation, installed capacity during the year was increased by 479,900 hp, a rise slightly above that of 1948 and well in excess of the prewar yearly rate of expansion of 300,000 hp. With the current addition, installed capacity in Canada now totals 11,622,668 hp.

During the year, primary power consumption continued to grow in practically all sections of the country, the demand being 3 percent higher than in 1948. To meet this continuing demand, a number of large developments now in a state of advanced construction will add about 1,560,000 hp within the next two years. Other developments are in the planning or preliminary construction stage, and long-range plans call for the development of other high-capacity sites.

Construction Activity in January Is 16 Percent Above January 1949

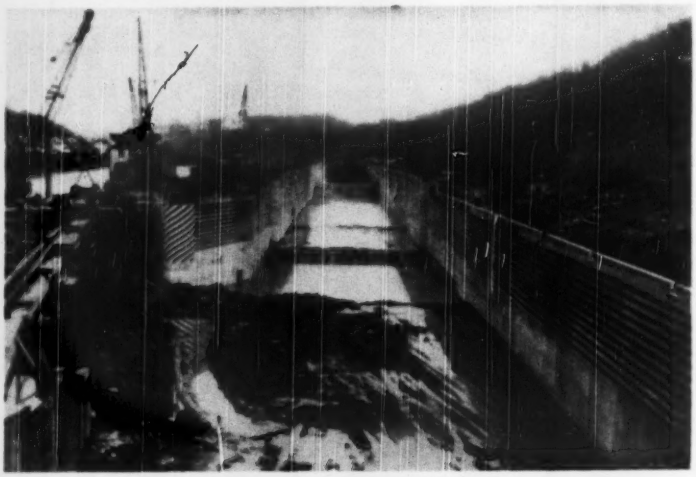
CONSTRUCTION ACTIVITY, LED by a large volume of home building, began the year at record pace, according to a joint report of the Labor Department's Bureau of Labor Statistics and the Department of Commerce. The total value of new construction put in place during January, estimated at $1½ billion, was 16 percent above the total for a year ago and set a new high for the month.

Private outlays for all types of new construction amounted to more than $1.1 billion—off 7 percent from December. Housing alone accounted for $650 million (nearly 60 percent of the January total), as unusually good mid-winter weather in many sections of the country permitted work to proceed on the large number of new dwellings placed under construction last fall. Investment in new dwellings was 37 percent greater than in January 1949.

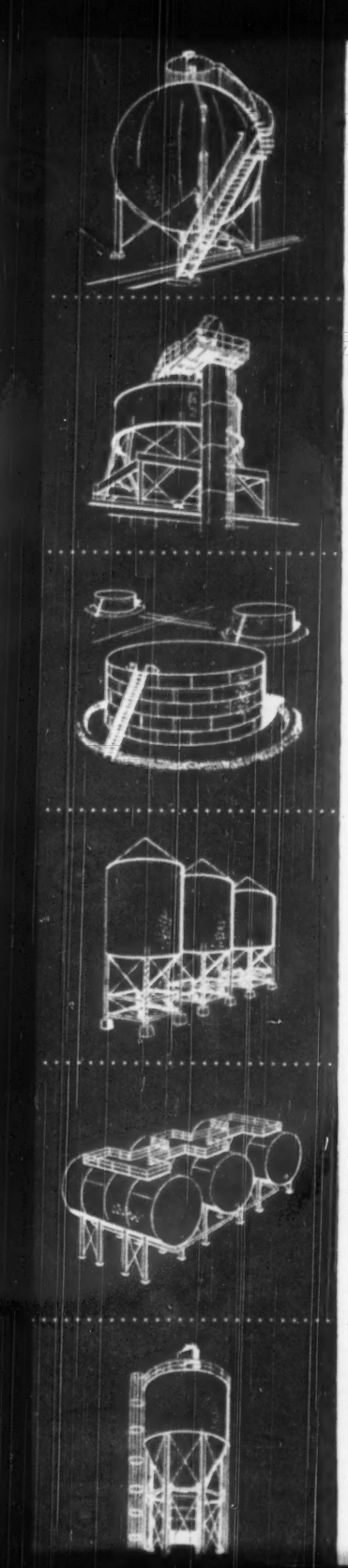
Expenditures for new industrial plants were about the same as in December, at a level considerably below that of a year ago. Outlays for new warehouse, office, and loft buildings increased 4 percent last month, while construction of stores, restaurants, and garages dropped by 14 percent. The volume of commercial building as a whole was somewhat lower at the beginning of this year than in January 1949. Construction outlays by privately owned public utilities declined seasonally in January, with the largest drop (19 per cent) in railroad construction.

Total public expenditures for new construction, after a less-than-seasonal decline to $360 million, were 24 percent higher than in January 1949. Most of the decline from December was in highway construction and conservation and development work. Public housing, school, hospital, and other institutional building construction continued well ahead of levels of a year earlier.

Army Lock and Dam on Monongahela Will Speed River Traffic



FIRST PHASE IN CONSTRUCTION of Army Corps of Engineers lock and dam on Monongahela River at Morgantown, W. Va., is completed by workmen of Dravo Corp., Pittsburgh, Pa., which has construction contract. View shows lock chamber just prior to flooding and with cofferdam still in place. Work on dam has also begun, and cofferdam has been completed on other side of river for construction of an abutment. Structure will complete chain of eight modernized locks and dams on Monongahela between Morgantown and Pittsburgh, for first time permitting shipment of coal from mining areas around Morgantown by water to Pittsburgh and points beyond. Approximate cost of project is $6,343,650.



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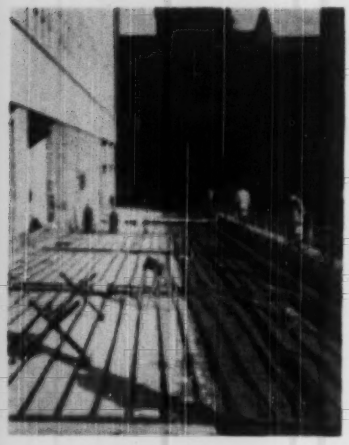

TO AVERT LIABILITY HAZARDS, owners of skyscraper under construction at 100 Park Avenue, New York, are installing $40,000 radiant heating system under sidewalk that will entirely prevent collection of snow and formation of ice. Steam from New York Steam Corp. will be piped through network of pipes and reinforcing that starts 1 ft from curb and extends full width of sidewalk on Park Avenue frontage and two side streets. Insulating layer of foam glass under sidewalk slab will prevent escape of heat downward. Kahn & Jacobs are building architects, and Jaros, Baum & Bolles consulting engineers on heating.

New Plan for Integrated Metropolitan Water Supply Submitted to Three Governors

CREATION BY INTERSTATE compact of a Delaware River Water Commission, which would be authorized to develop and operate an integrated water project for supplying the metropolitan areas of New York, New Jersey, and Philadelphia, is advocated in an engineering report recently released by the Interstate Commission on the Delaware River Basin, better known as Incodel.

Transmitted simultaneously to the governors of New York, New Jersey, and Pennsylvania, the report recommends construction of a series of reservoirs in the upper Delaware Basin above the Water Gap, which would ultimately yield more than 1,500 mgd for New York City, northeastern New Jersey, the southern New Jersey metropolitan district, and the Philadelphia area. In addition to furnishing water supplies, the proposed project provides for the storage of sufficient water to maintain a minimum daily flow of about 3,000,000,000 gal in the Delaware River at Trenton, N.J. It is claimed that this use of the project, which will almost double present dry-weather flows at Trenton, will practically eliminate annual damage of about $2,000,000 to industries and oyster production farms caused by the invasion of brackish water.

The proposed plan calls for development of the water-supply project in two stages, the first to cost between $500,000,000 and $600,000,000 and require from 10 to 15 years for completion. This stage, which would assure New York City and northern New Jersey a supply of 450 mgd, involves construction of a reservoir on the West Branch of the Delaware River at Cannonsville, N.Y., a diversion dam on the main river near Barryville, N.Y., which would impound 10,000,000,000 gal of flood-flow water; construction of a storage reservoir on the lower Neversink River and on Basher Kill, extending from Godeffroy to Summitville, N.Y.; and finally construction of an aqueduct from the upper part of the Godeffroy Reservoir to the supply systems of New York City and northern New Jersey. This project can be extended as needs dictate, according to the report, by construction of additional storage reservoirs on Flat Brook in New Jersey, and at Fish's Eddy on the East Branch of the Delaware.

Stating that Philadelphia water supplies are at present adequate, the report anticipates that the city's growth may ultimately make expanded supplies necessary. When that occurs, it recommends construction of a huge storage reservoir on the main channel of the Delaware at Wallpack Bend. These supplies would also be available to southern New Jersey areas. The over-all project calls for impounding 312,000,000,000 gal of water in the first stage, and about 652,000,000,000 gal in the second.

The report was prepared by Malcolm Pirnie, Engineers, New York City, and Albright & Friel, Inc., Philadelphia consultants. James H. Allen, M. ASCE, is executive secretary of Incodel.

Army Announces Designers of Veterans' Hospital in N.Y.C.

AWARD OF CONTRACTS for the design of a large veterans' hospital, which will occupy a two-block site on the East Side of Manhattan, is announced by the District Engineer of the New York District of the Corps of Engineers.

To be located on the site bounded by 23rd and 25th Streets and First Avenue and Avenue A, the project will be designed by the New York architectural firm of Alfred Hopkins & Associates; Guy B. Panero, Engineers, in charge of mechanical design; Fred N. Severud, M. ASCE, structural design; and A. Carl Stelling, landscape architect. Preliminary design is already under way, and the New York District Office of the Corps of Engineers will be in charge of the construction program.

With the completion of the project, the entire area from 34th to 23rd Streets between First Avenue and Avenue A will be occupied by hospital facilities, making it one of the most outstanding concentrations of medical institutions in the world. The 455 by 650-ft. site is now occupied mainly by commercial and warehouse buildings.

Ohio Sanitation Group Speeds Pollution Control

INDUSTRIES DISCHARGING WASTES into Ohio Basin waters will be asked to send representatives for group conferences with the Ohio River Valley Water Sanitation Commission, as the result of action taken at the recent quarterly meeting of the Commission in Cincinnati. These representatives will report progress on treatment installations and receive clarification of their responsibilities in the eight-state campaign for stream cleanup initiated by the Commission.

Pointing to the fact that more than a year has elapsed since all the industrial plants in the valley were asked to cooperate in the interstate agreement on pollution abatement, Joseph L. Quinn, Jr., M. ASCE, chairman of the Commission, said "Now we want to determine what has been done in this period as well as hear from industrial groups how the Commission can expedite progress in the control of certain waste discharges."

During the meeting approval was also given to a resolution urging the federal government to assume costs for providing low-flow regulation in the proposed Mahoning-Grand River floodway in Ohio.

At a joint luncheon with members of the national Water Pollution Control Advisory Board of the U.S. Public Health Service sponsored by the Commission during the two-day program, James W. Follin, M. ASCE, assistant administrator of the General Services Administration, told the joint group that, "Prospects for federal grants to communities for the construction of sewage-treatment works are very meager."

Koppers Co. to Supervise ECA Program in Turkey

A $50,000,000 PROGRAM of engineering and construction work in Turkey, under the Economic Cooperation Administration, will be supervised by Koppers Co., Inc., of Pittsburgh, according to an announcement from Joseph Becker, vice-president and general manager of Koppers Engineering and Construction Division.

The contract covers supervision of construction of a harbor; improvement of mining properties including construction of coal washeries; construction of approximately eight miles of railroad and a complete switching and transfer station; and building of two new docks and a large breakwater at the Black Sea port of Zonguldak, which will be the center of much of the new work. Equipment for the projects will be purchased in this country, Europe, and Turkey.

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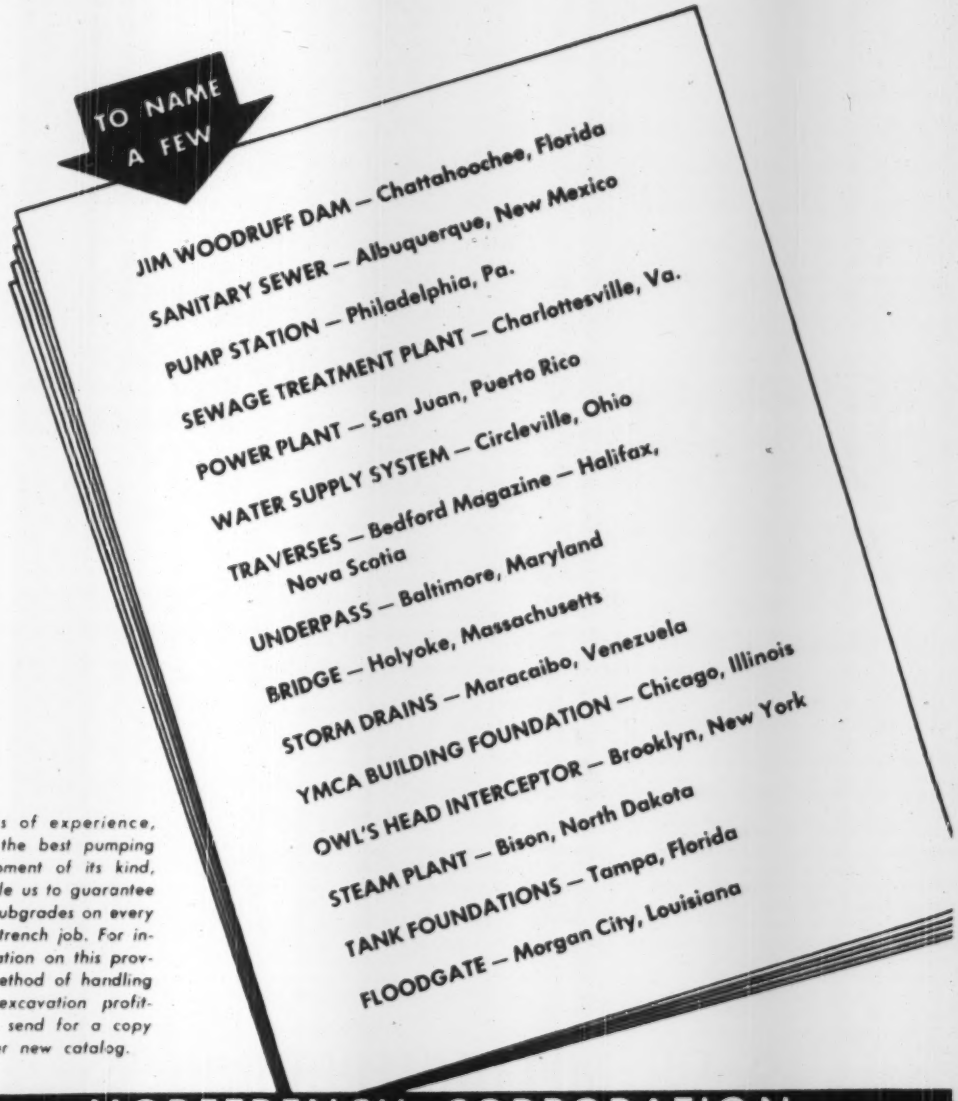
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UNDERPASS — Baltimore, Maryland
BRIDGE — Holyoke, Massachusetts
STORM DRAINS — Maracaibo, Venezuela
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D. B. Steinman Heads International Structural Association

DR. DAVID B. STEINMAN, M. ASCE, was elected chairman of the U. S. Council of the International Association for Bridge and Structural Engineering at the recent cooperative meeting held during the ASCE Annual Meeting. Other Council members elected were Messrs. L. Coff, and F. B. Farquharson, J. M. Garrelts, F. W. Panhorst, J. J. Parcel, R. H. Sherlock and C. Winter, all members ASCE. Dr. T. C. Kavanagh, Assoc. M. ASCE, professor of civil engineering at Pennsylvania State College, State College, Pa., will continue as secretary-treasurer.

A remarkable increase in interest on the part of American structural engineers in developments and practices in other countries, as evidenced by the upswing in membership in the Association here, was reported by the secretary. Of the Association's present membership of close to 2,000 structural engineers throughout the world, the U. S. contingent is now one of the largest, and interest in it has been steadily increasing.

Important steps were taken at the meeting to implement the Association's aim of serving as an international clearing house for technical information in the field of structural engineering, and to prepare for the Congress to be held in England in 1952. In addition, a more active program was planned for the Association, including a cooperative session at the next annual meeting, and more widespread dissemination of information concerning the Association to structural and construction engineers in this country most likely to benefit from its activities.

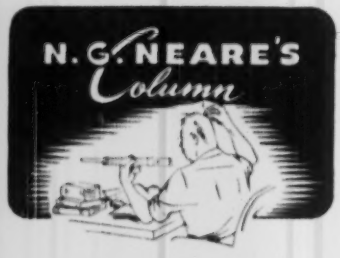
Organized in 1929, the Association has a long list of publications that are widely recognized as a prime source of information on new structural and construction research and development. The most recent publication—Volume 9 and the Preliminary and Final Reports of the Third Congress at Liege—include new developments in such fields as prestressed concrete, welding, concrete technology, suspension bridges, shell construction, plates, buckling problems, inelastic behavior and factor of safety, vibrations, etc., as well as detailed descriptive matter concerning outstanding structures recently undertaken throughout the world. A big demand for the volumes is reported.

CORRECTION

IN THE FEBRUARY canoe-race problem, the course should have been 1.5 miles long, not 1.6 miles, in order to have a buoy every furlong.

Al's client owned a triangular lot ABC, the sides of which were 3 consecutive integers, but it was too small for a proposed mile-long hot-dog stand and he didn't like the shape. So he bought and Al surveyed an adjoining triangle BCD with twice the area and perimeter of ABC and with CD twice as long as AC. Now who's unhappy and why?"

[Kens and Cals were: Anne Othernut (J. Charles Rathbun), Berndt Rivett (James A. Collins), E. P. Goodrich, R. E. Phillco, George B. Richardson and Abbot Sackheim. Guest Professor Sauer Doe was Marvin A. Larsen.]



R. Robinson Rowe, M. ASCE

"SNAKES," SAID PROFESSOR Neare, "are what everybody can do without enthusiastically. That's why Pat's a hero in Eire and Dr. Johnson memorized a whole chapter (72) of Horrebow's classic on Iceland, also why Guest Professor Sauer Doe is famous in Alaska for his ophidian-oblivion theory, from which he derived his problem of the three telescoping snakes. I think, Sauer, that you'll have an argument with Joe Kerr."

"Then let's start with it, Joe," invited Professor Doe. "Remember, when the three snakes started swallowing each other, each was 5 ft long and weighed 4 lb and my question was how much snake each snake had swallowed when they were telescoped to a circle one foot in circumference."

"Easy," replied Joe, "if you look at how much snake each snake *hadn't* swallowed. The snake snouts were 4 in. apart, so each could see 4 in. of one, 8 in. of another and 12 in. of itself, or 2 ft altogether that it hadn't swallowed. The other 13 ft weighed 10.4 lb."

"Wait a minute," yelled Titus Wadhouse. "If each swallowed 10.4 lb, that's 31.2 lb altogether, but we only started with 12 lb. I say that all is swallowed except the outer 1 ft circle, that is, 11.2 lb is swallowed and, by symmetry, each snake has had a snack of 3.73 lb."

"Let's be rational," suggested Ken Bridgewater. "Each snake was tending to his own business, swallowing the snake ahead without concern over what the other snakes were doing. Each had swallowed 4 ft 8 in. of a rapidly growing snake, and this is the answer, since 'how much?' can be answered in feet as well as in pounds."

"I agree with Ken," said Cal Klater, "but the answer in pounds is interesting and easily derived. The topology of the snarl of snakes is a complicated figure, but if we develop it by straightening out the snakes in their correct longitudinal interrelationship (Fig. 1) and divide it into 1-ft bands, the bands in order represent original length and weight which has been effectively swallowed 0, $1\frac{1}{2}$, 2, 3, 4 or 5 times. Counting the segments so many times gives the answer, 28 lb. Of course, I had to assume that a snake had the same shape inside as outside, and negligible digestion during the maneuver."

"A reasonable premise and a right answer," agreed Professor Doe. "If any of you are interested in snake extermination, I'll be glad to give you my general solution, which is easily derived from Cal's figure. How'd I do, Noah?"

"Nicely so far, Sauer, but Joe and Titus are likely to stop you on the way out. Before the fireworks begin, let's try to interest them in a new problem, another from the notebook of the surveyor, Al E. Dayde.

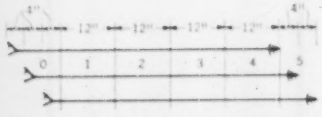


FIG. 1. DEVELOPMENT UNSNARLS the snacking snakes.

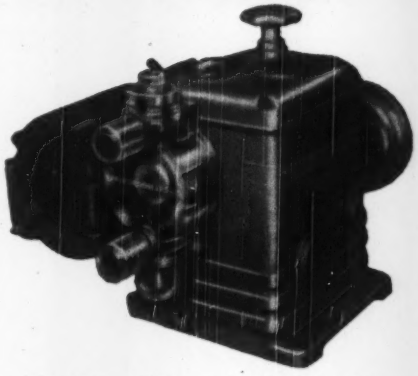
NEW IN Education

AERIAL PHOTOGRAPHIC SURVEYS in relation to highway engineering are being introduced in both graduate and undergraduate courses in transportation at Cornell University, according to an announcement from Donald J. Belcher, Assoc. M. ASCE, professor of civil engineering and head of the transportation department. The engineering department believes that the increased use of aerial photographs in the field phases of engineering makes training in these problems a necessary part of every civil engineer's education. Thus all highway engineering students at Cornell are kept abreast of advanced practice in highway methods.

INDUSTRIAL GRANTS-IN-AID totaling $800,000 to the Massachusetts Institute of Technology have been announced by Dr. James R. Killian, Jr., president of the Institute. The grants bring total gifts to the Institute in its current development program to $6,526,914.02.

CALIFORNIA'S STREET AND highway problems were studied by 622 engineers and highway officials who participated in two recent conferences sponsored by the state's Institute of Transportation and Traffic Engineering, which is operated by the University of California. A three-day conference, on January 30, drew a large attendance to the annual "road school" on the Los Angeles campus of the university, and on February 3 there was a one-day conference on the design of urban arterial routes on the Berkeley campus. Highlight of the design sessions was a preview of geometric designs for arterial highways, presented by Joseph A. Barnett, M. ASCE, chief of the Urban Design Branch, U. S. Bureau of Public Roads, Washington, D.C.

Does YOUR Pumped Water Supply Need Treating?



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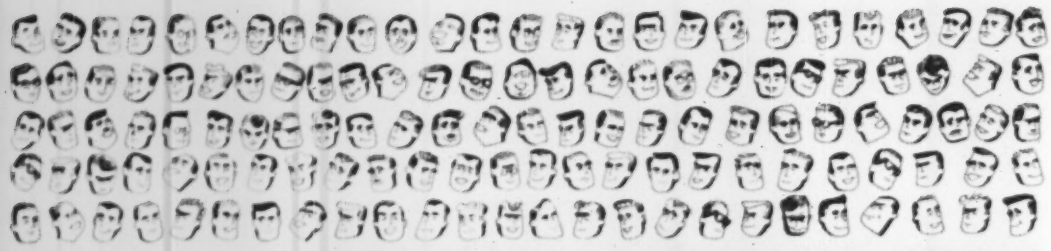
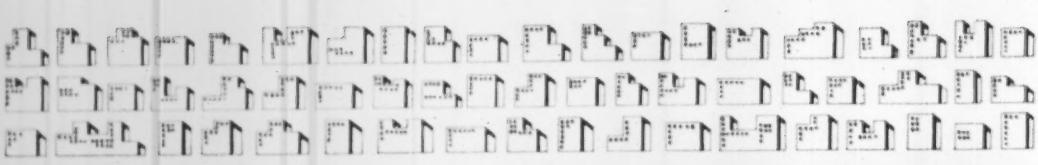
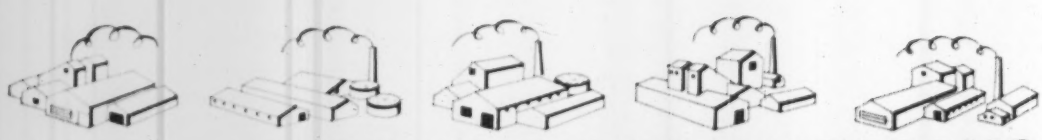


257 FIELD REPRESENTATIVES

48 INSTALLATION INSTRUCTORS



58 SALES OFFICES



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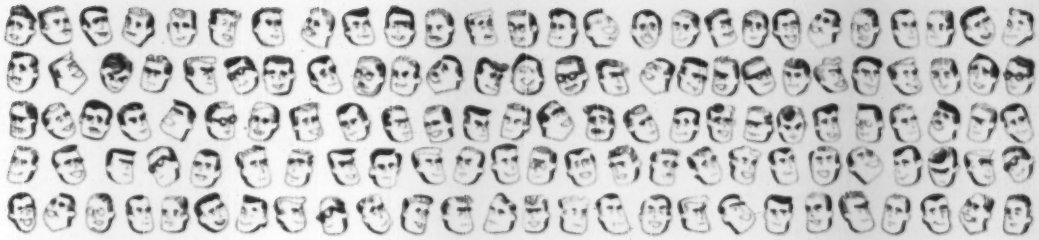

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Its facilities include more than 250 field representatives with headquarters in 58 cities. It also comprises a staff of competent installation instructors who explain recommended installation practices to pipe-laying crews. This Johns-Manville service is an important factor in helping to assure the installation economies as well as the long-term *overall* economies that go with Transite Pressure Pipe.

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NEWS OF Engineers

Stanley T. Barker has been appointed to the post of assistant director of the Bureau of Environmental Sanitation of the New York State Health Department. Joining the engineering staff of the department in 1936, Mr. Barker has served in both the water and sewerage sections, most recently as chief of the Sewage and Wastes Section.

Harland Bartholomew, president, Harland Bartholomew & Associates, city planning engineers of St. Louis, Mo., recently was named to a 20-member advisory agency on slum clearance and urban development by the administrator of the Housing and Home Finance Agency, a national organization. The Committee will meet bi-monthly to assist in formulating policies of the slum clearance and urban redevelopment program, which provides federal assistance to communities.

Gordon E. Mau is now serving as chief of the water pollution control section of the Kansas State Board of Health.

Ralph G. Champagne is now city engineer for Troy, N.Y., succeeding **Charles F. Crowley,** who recently retired after 20 years of service. Previously, Mr. Champagne was assistant director of the Bureau of Research and Statistics, New York State Department of Public Works. He is president of the Mohawk-Hudson Section of the Society.

Frederick W. Crane recently was appointed commissioner of public works for the City of Buffalo, N.Y.

Andrew M. Komora announces the opening of an engineering and consulting office at 31 Valhalla Drive, Ann Arbor, Mich., specializing in hydroelectric power developments.

John L. McRae, formerly with the soil mechanics department of Northwestern University, has become connected with the Soil Testing Services, Inc., of Chicago, Ill., as research and testing engineer.

James W. Follin is now special assistant to the General Services Administrator. He will be engaged on planning and public works programs of the GSA. Prior to the recent government reorganization, Mr. Follin was with the Federal Works Agency as assistant administrator.

Edward Hyatt, state engineer and chief of the Division of Water Resources of the California State Department of Public Works, has retired after more than 35 years of service. He will be succeeded by **Arthur D. Edmonston,** who has been deputy state engineer. A graduate of Stanford University, class of 1912, Mr. Hyatt has been employed by the California Highway Commission, the Water Commission, and the Division of Water Rights. He is presently serving ex-officio on many statutory boards and commissions. Mr. Hyatt is a past-president of the Sacramento Section of the Society.

Edward Hyatt

Ralph N. Brescia, formerly supervisor of the Estimating and Analysis Section of the Construction Division of the Veterans Administration, New York City, has been appointed civil engineer (construction) on the building of permanent hospital facilities of the U.S. Naval Hospital, St. Albans, N.Y.

Thane E. Brown has accepted the appointment as chief engineer of the Commission of Public Docks, Portland, Ore. Mr. Brown has served the organization successively as chief design engineer, and since 1949 as acting chief engineer.

Courtlandt Eaton, consultant on the chief engineer's staff of the U.S. Bureau of Reclamation, Denver, Colo., has resigned to enter private practice. Mr. Eaton has served as irrigation engineer for the State of California, chief engineer for the Los Angeles County Flood Control District, and as a consulting engineer advising on groundwater developments in Palestine.

Walter D. Binger has resigned as vice-president of the City Investing Co., of New York, to become associated with Frederic R. Harris, Inc., New York and Philadelphia consulting engineering firm. Mr. Binger will also continue with the City Investing Co. in a consulting capacity.

Frank Stermitz, a native of Montana for the past 19 years with the U.S. Geological Survey, has become district engineer in charge of survey investigations in Montana, at Helena.

L. H. Powell has been named chief engineer of the Sante Fe Railway System's Coast Lines, with headquarters in Los Angeles, Calif.

Lawrence T. Beck, managing associate of Lawrence T. Beck & Associates, consulting engineers of New York City, has been appointed to the Board of Trustees of the Citizens Budget Commission, Inc., a fact-finding agency created in 1932 to promote more efficient government in the City of New York.

(*Continued on page 76*)

Members Honored for Engineering Service to City of New York

HONORARY MEMBERSHIP IN the Municipal Engineers of the City of New York was conferred upon three charter members—John C. Riedel, Lazarus White, and Philip F. Farley, all members ASCE—for long and outstanding service to the city at the recent annual meeting of the organization. A fourth ASCE member, Alfred Brahdy, division engineer in charge of design of structures for the Board of Transportation, received a special medal for a technical paper on "Design of Buildings for the New York City Transit System," published in the Municipal Engineers journal, at the same meeting.

John C. Riedel

Lazarus White

Philip P. Farley

A veteran city employee, Mr. Riedel has been connected with city engineering departments since 1901. At present he is chief engineer of the Board of Estimate, chairman of the Traffic Commission, and a member of the City Planning Commission. Until recently he was also actively engaged as lecturer in engineering at Cooper Union and Brooklyn Polytechnic Institute. He is the author of numerous technical papers and articles and has been honored by many professional and civic associations here and abroad.

Founder of the New York City heavy construction firm of Spencer, White & Prentis, Mr. White setved as president of the organization from 1919 until recently. He is author of a book entitled *The Catskill Aqueduct* and co-author, with E. A. Prentis, of several authoritative volumes on underpinning and cofferdams. In association with Mr. Prentis, he invented the Pretest System of underpinning heavy structures. Long active in ASCE, Mr. White served as Director from 1940 to 1942.

As consulting engineer to the President of the Borough of Brooklyn since 1918, Mr. Farley has advised on all engineering projects in the Borough for the past 30 years. In addition, he is consulted on engineering matters of city-wide scope that are under consideration by the Borough President as member of the Board of Estimate.

Sprinkler Tank Reduces Insurance Premiums

"The new tank reduced premiums 30 per cent and will pay for itself out of insurance premiums in from 10 to 12 years."

This quotation is taken from a letter from the Barber-Greene Company of Aurora, Illinois. It is dramatic evidence that a Horton elevated tank provides economic savings as well as peace-of-mind when you install it for fire protection.

Why does an automatic sprinkler system with a Horton elevated tank reduce insurance premiums like this and why do insurance companies regard this type of protection so favorably? Because the tank is your assurance that you have a dependable water supply for plant protection. The instant a fire starts, water—under gravity pressure—sprays from the first sprinkler head that opens.

You protect lives and property—and save insurance dollars—when you make a Horton elevated tank an integral part of the fire-fighting system. Write the nearest office for full details and quotations.

Above: 100,000-gal. Horton ellipsoidal-bottom tank at the Barber-Greene Company's Aurora, Illinois, plant. It provides a secondary supply for emergency fire protection. Ellipsoidal bottom elevated water tanks are available in standard capacities from 15,000 to 500,000 gallons.

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Boston 10	1009—201 Devonshire St.	Houston 2	2128 National Standard Bldg.	San Francisco 11	1284—22 Battery St. Bldg.
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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

(*Continued from page 74*)

E. A. Bailey, after 20 years with the Bureau of Reclamation, has retired. Mr. Bailey entered government service upon his graduation from the University of California in 1903. For the past few years he has been on duty at Chico, Calif.

James Conforti, Jr., has accepted a position on the staff of William L. Crow Construction Co., with offices in New York City. Mr. Conforti served as a lieutenant commander with the Construction Battalion of the U.S. Navy during World War II and is now commanding officer of the U.S.N.R. Construction Battalion at Fort Schuyler. In addition he is a member of the Bar, having obtained a law degree from Temple University.

L. M. Lovejoy, formerly with the U.S. Engineers in the Canal Zone, has accepted the position of resident engineer with the Kansas State Highway Commission, at Frankfort. Prior to his connection with the Corps of Engineers, Mr. Lovejoy served the highway commission for 14 years.

T. W. Ogilvie, county surveyor of Lassen County, California, has been appointed a member of the Lahontan Regional Board of the California State Water Pollution Board, which has jurisdiction over the portion of California lying east of the Sierra Nevada mountains.

William Brewster, who retired recently as West Virginia engineer for the Public Roads Administration, has been appointed by the State Road Commission of West Virginia as a special consultant at Charleston.

Maj. Gen. Hugh J. Casey, chief of the Ohio River Division of the Corps of Engineers at Cincinnati, has been retired from the Army.

O. Paul Lance announces that the partnership of Lance & Mitchell has been dissolved and will be succeeded by the firm of O. Paul Lance, consulting engineer, with offices at 1021 ½ East Missouri, El Paso, Tex.

T. Keith Legaré, former Director of ASCE and engineer of Columbia, S.C., begins his 27th year as executive secretary of the National Council of State Boards of Engineering Examiners, an organization which he once served as president. From 1929-1933 Mr. Legare served as a member of ASCE's Committee on Registration of Engineers and, for two years, was chairman during the time the original draft of the Model Law for the Registration of Engineers and Land Surveyors was compiled.

T. Keith Legaré

James L. Kehoe announces that he has resumed the practice of engineering, with headquarters in Rye, N.Y. Mr. Kehoe has had a career of over 30 years in public works.

N. W. Haner, consultant of Portland, Ore., announces the formation of an association under the firm name of N. W. Haner and Associates, engineers-consultants, 220 S.W. Alder St., Portland. His associates are **Carl R. Skooglund** and **Sully A. Ross.**

Wayne A. Perkins, formerly senior engineer on the design and construction of dams in the California State Division of Water Resources, announces the establishment of a consulting engineering office at 1180 Perkins Way, Sacramento.

John Charles Riedel, chief engineer for the New York City's Board of Estimate and Apportionment, received the Cooper Union 19th Anniversary Alumni Award as the Cooper Union graduate "who has done the most for the City and the Institution," during the annual Founder's Day dinner, sponsored by the Alumni Association.

David C. Hastings is the new supervisor of tracks and engineering for the Richmond, Fredericksburg & Potomac Railroad, Fredericksburg, Va. During the recent war Mr. Hastings served four years as a major in the Corps of Engineers.

I. Alvin Pasarew, director of the State Planning Commission of Maryland, has been appointed chairman of the Public Works Planning Committees of the Association of State Planning and Development Agencies.

Gloster P. Hevenor has been named executive vice-president of the Aquadyne Corp., of New York City. In this capacity Mr. Hevenor will be responsible for activity in the field of dust control in industry and product development in the applications of "wet water" for fire fighting and sterilization.

Lee H. St. John, consulting civil and valuation engineer of Seattle, Wash., has been appointed chief deputy to County Assessor Ralph S. Stacy.

Herb Deardorff has been transferred to the traffic engineering section of the California Divisions of Highways.

Theodore Belzner is being retained as bridge inspector-in-charge of Brooklyn Bridge by the Department of Public Works of New York City. Mr. Belzner is chairman of the Emily Warren Roebling Memorial Committee of the Brooklyn Engineers Club.

Ralph F. Rhodes has retired after 40 years with the Corps of Engineers, most recently as head engineer and technical adviser of the Savannah, Ga., District. Mr. Rhodes will be retained as a consulting engineer to work on the Tidal Hydraulics Committee, a national body supervising all studies of tidal hydraulics made by the Engineers.

Howard S. Morse, after nearly a quarter century of management of the Indianapolis Water Co., Indianapolis, Ind., has retired as executive vice-president, but will continue as a member of the board of directors. Mr. Morse began his long tenure as manager in 1925, was named vice-president and general manager in 1938, and executive vice-president early in 1949. Active in Society affairs, Mr. Morse served as Director from District 9 from 1935-1937, president of the Indiana Section, and on many Technical Division committees. He is a graduate of MIT.

Howard S. Morse

M. U. Snoderly, of Nashville, Tenn., has accepted the position of consultant on engineering and public works at the University of Tennessee. Mr. Snoderly will be on the staff of the university's Engineering Experiment Station, but assigned for full-time duties with the Tennessee Municipal Technical Advisory Service. In this capacity, he will advise officials on proposed public works and other engineering problems.

M. Hirschthal, after 42 years of service with the Delaware, Lackawanna & Western Railroad, has retired to enter private consulting practice under the firm name of M. Hirschthal, with offices at 420 Madison Avenue, New York City.

Among the structural engineering firms elected to membership in the New York Association of Consulting Engineers are **Jacob Feld, (Albert J.) Wilcox & (Archie M.) Erickson,** members of ASCE.

S. E. Blystone has joined the staff of the Virginia Highway Department as assistant resident engineer for Appomattox and Campbell counties.

J. I. Thomas, formerly head engineer of the Great Lakes Division of the Corps of Engineers, has been named project engineer for the Corps on Pine Flat Dam, which will be constructed on Kings River near Fresno, Calif.

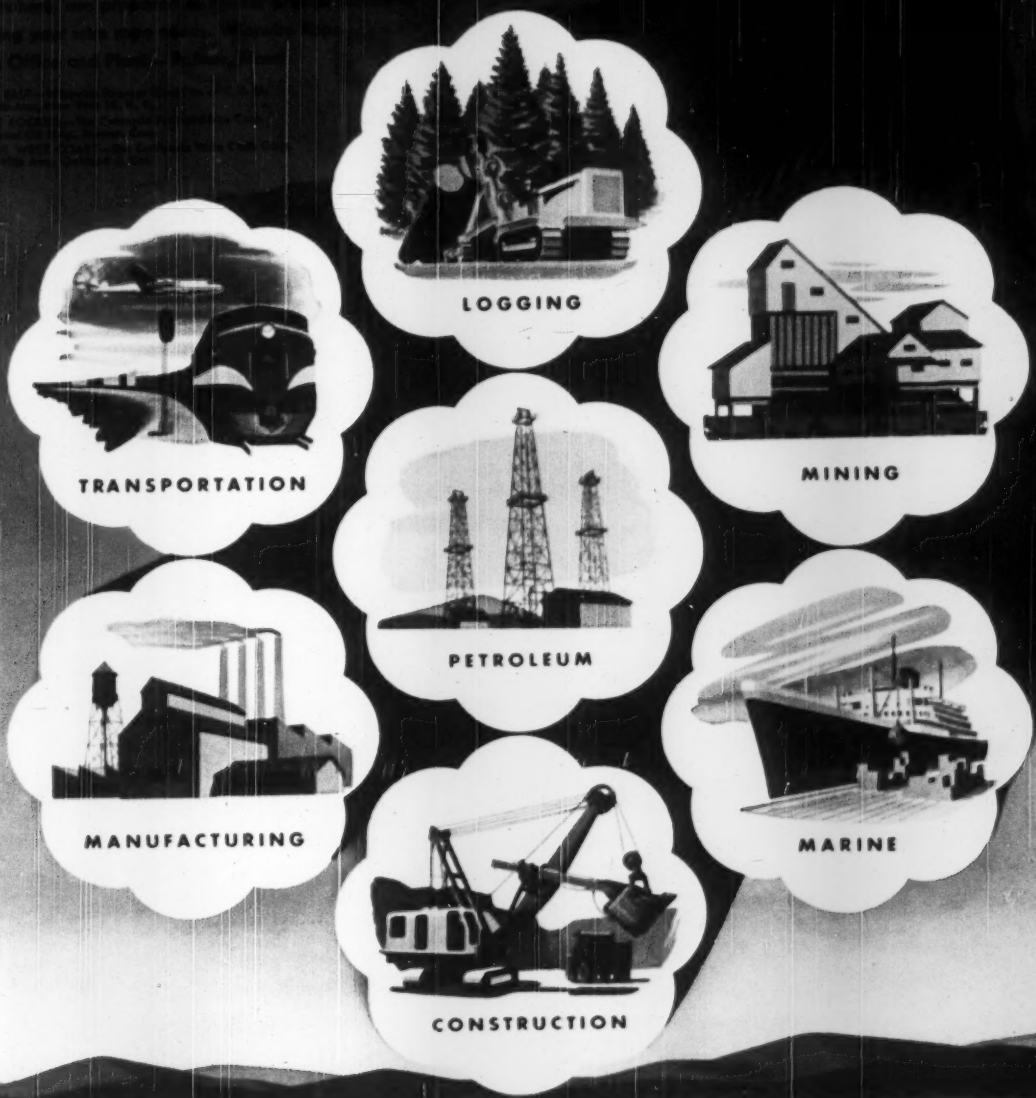
E. J. L. Peterson is now district engineer for the California State Division of Highways in San Luis Obispo.

Ray E. Hertel is now associated with **M. A. Jenkins,** contractor in the Sacramento, Calif., area.

Harold D. Briley and **Harry E. Wild** announce the organization of Briley, Wild & Associates, Inc., consulting engineers with offices at 550 North Oleander Avenue, Daytona Beach, Fla.

(*Continued on page 80*)

CF&I


LOGGING
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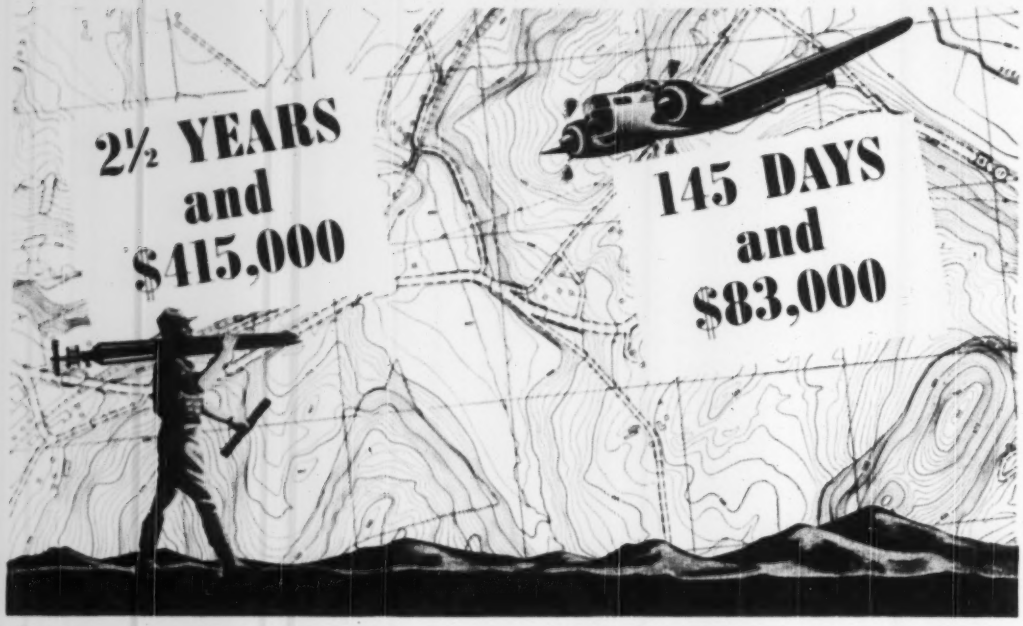
What Does Your Mapping Work Cost?



TOPOGRAPHIC FACTS were needed for the Pennsylvania Turnpike's eastern extension. The transit and line method estimate was $415,000 and 2½ years' time. Too slow—and too expensive.

Aero Service mapping planes flew the 140-mile route, taking 250 photographs to be translated into accurate contour maps by photogrammetry. First maps were delivered 45 days after photography—entire schedule completed in just 145 days. Net cost of the job was $83,000, *one-fifth of the cost of ground surveys.**

What will your mapping work cost?

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Let AERO's photogrammetric engineers explain how our experience and services can expedite your long-range planning. If you have an interest in oil or mineral exploration, industrial development, or any large-scale enterprise anywhere needing maps, let us meet with you. Write AERO today.

**AUTHORITY: Gannett, Fleming, Corddry and Carpenter, design and location engineers for the Pennsylvania Turnpike extension.*

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Further proof is Maryland's famous test road. Here, 19 years ago, engineers laid 14 different types of pavement on the same road. Today, the **BITUMULS** section is in excellent condition—while most of the other sections have long since been replaced or surfaced.

Engineers agree that no better pavement than macadam has ever been built. It attains greatest perfection using **Modern Equipment** and bonding with cold, quick-setting **BITUMULS Emulsified Asphalt.**

Stable in hot weather—smooth riding—non-skid, sealed surface.

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E. Providence 14, R. I. • San Juan 23, P. R. • Mobile, Ala.

(*Continued from page 76*)

John M. Server, Jr., previously editor of *Western Construction News*, is now engaged by the *Southwest Builder and Contractor*, of Los Angeles, in a similar capacity. Mr. Server has been connected with the Los Angeles Flood Control District, assisting in the preparation of plans on assessment and costs for improvements and in the design of debris basins, channels, and other flood control works in the Montrose-La Crescenta area of Southern California. He has been a news reporter for *Engineering News-Record*.

John M. Server, Jr.

L. F. Harza, president of Harza Engineering Co., of Chicago, Ill., is now in El Salvador, Central America, where his firm is acting as consultant for the Comision Ejecutiva Hidroelectrica del Rio Lempa of El Salvador and is engaged on the design of the Chorrera Del Guayabo Hydroelectric Plant to be erected on the Rio Lempa River. A World Bank loan of $12,545,000 has been made for construction of the project.

R. B. Ward was transferred to the International Boundary & Water Commission at Laredo, Tex. Mr. Ward will work as construction engineer on the United States Section of the Falcon Dam and Power Plant, a joint venture with Mexico, to be constructed across the Rio Grande River about 75 miles downstream from Laredo.

Charles S. Heidel has been appointed field representative of the U.S. Geological Survey on matters pertaining to international water problems of the St. Mary, Milk, and Belly rivers and their tributaries. Mr. Heidel will remain in Helena but will be under the jurisdiction of the Washington, D.C., office.

Charles W. Harris, professor of engineering at the University of Washington for approximately 44 years, has received the highest honor the university can bestow upon an alumnus, "Alumnus Summa Laude Dignatus," in recognition of outstanding contributions to science. He was particularly cited for research work in solving hydraulics problems in connection with the Hell's Gate project on the Fraser River. A leading authority in the field of hydraulics, Professor Harris has written widely on the subject and has served as a consultant on numerous projects.

John P. Tansey, Jr., has been appointed assistant to Public Works Commissioner Hewitt, of Chicago, Ill. Mr. Tansey has been employed by the E. I. du Pont de Nemours & Co., the Herlihy Mid-Continent Construction Co., and was in the Navy Seabees during World War II. He recently received his B.S. degree from the Illinois Institute of Technology.

Kenneth K. King, former director of public works in Kansas City, Mo., has accepted a temporary appointment as director of public work and utilities for Phoenix, Ariz., pending action by the City Council. This is the first step toward reorganization plans of the city's municipal and administrative agencies.

Herbert G. Crowle, since 1946 chief of flood control for the San Francisco District of the Corps of Engineers, is now engineer for the Alameda County (California) Flood Control and Water Conservation District.

Milton A. Karp has been named chief engineer of the Luria Engineering Corp., of New York, N.Y., and will have headquarters at Bethlehem, Pa.

Ira E. Taylor, has been named engineer of secondary roads for Division 5-N of the Bureau of Public Roads, with headquarters at St. Paul, Minn. Mr. Taylor will correlate the activities of the counties, states, and the BPR in Wisconsin, Minnesota, North Dakota, and South Dakota. During the recent war he served 3½ years in the Corps of Engineers.

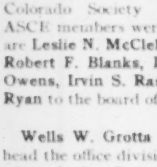
A. V. Karpov, consulting engineer of New York, is in New Delhi, India, where he is acting as consultant to the Central Water Power, Irrigation, and Navigation Commission. Mr. Karpov's stay of several months in India will round out a career that has involved experience in Africa, Central and South America, and Europe.

H. G. Haynes, of Charleston, S.C., has been elected president of the South Carolina Society of Engineers.

During the annual convention of the Colorado Society of Engineers, several ASCE members were elected to office; they are **Leslie N. McClellan**, vice-president, and **Robert F. Blanks, Dana Kepner, Terry J. Owens, Irvin S. Rasmusson**, and **Alfred J. Ryan** to the board of directors.

Wells W. Grotta has been appointed to head the office division of the Hartford District of the Connecticut State Highway Commission.

George K. Leonard, who has been on the staff of the Tennessee Valley Authority for several years, was recently transferred from project manager of the Upper Holston Projects to the position of chief construction engineer for the TVA at Knoxville. Mr. Leonard is author of an article on blasting rock for the South Holston Dam, which appears elsewhere in this issue. Before going to the TVA, he was general superintendent of the Minneapolis Dredging Co. and the Martin Wunderlich Co. on the construction of George P. Kingsley Dam in Nebraska and numerous other projects.



George K. Leonard

Deceased

Wayne M. Bidwell (Assoc. M. '47) of Laredo, Tex., died on November 11, at the age of 54. For a number of years Mr. Bidwell had been with the International Boundary Commission, which he served as junior engineer, assistant hydrographic engineer, and hydrographic engineer. He was educated at Oberlin College and Ohio Northern University.

Seward Charles (M. '29) who was connected with the Veterans' Administration, Washington, D.C., died September 6, 1948, according to word just received by the Society. He was 66. Mr. Charles had been in the Office of the Superintendent of the U.S. Capitol on the design of House and Senate offices and facilities, and structural engineer for J. H. de Sibour, Washington architect, on capital city structures. He had been appraisal engineer for the Bureau of Internal Revenue and structural engineer for the Public Buildings Administration, transferring to the Veterans' Administration in 1945.

John Henry Cook (M. '10) of Ridgewood, N.J., died at his home there on January 28. Mr. Cook, who was 90, was for many years connected with the Passaic Valley Water Commission and he had been president of the Passaic Consolidated Water Co. Of recent years he headed the Society for Establishing Useful Manufactures, with headquarters in Paterson, N.J. Mr. Cook was an honorary member of the American Water Works Association.

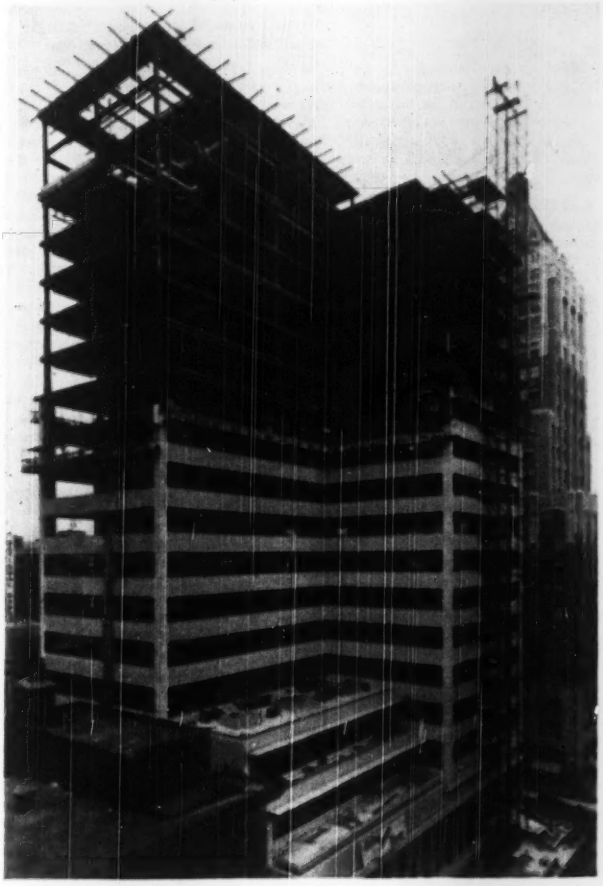
Burgis Greenacre Coy (M. '18) city engineer of Fort Collins, Colo., died there on January 9, at the age of 70. A graduate of Rensselaer Polytechnic Institute, Mr. Coy had early experience as division engineer for the Laramie-Poudre Reservoirs and Irrigation Co., and was in general engineering practice from 1912 to 1923, except for overseas service in the Corps of Engineers in World War I. Later he was resident engineer on construction of the East Portal of the Moffet Tunnel, and superintendent for E. J. Lord, Ltd., on tunnel construction in Honolulu. He had been city engineer and assistant commissioner of works at Fort Collins since 1932. In 1912 Mr. Coy won the Society's Thomas Fitch Rowland Prize for a TRANSACTIONS paper on the Laramie-Poudre Tunnel.

Chandler Davis (M. '80) retired engineer of New York City, died recently at the age of 88. A graduate of Harvard University, Mr. Davis had been with the New York City Department of Docks and, for some years, had a consulting practice in New York, specializing in harbor and highway work and in execution of contracts. He served in the Army in World War I.

Frederick Otis Dolson (M. '24) former vice-president and general manager of the California Electric Power Co., Riverside,

(*Continued on page 82*)

New Bank Building Rises on Tulsa Skyline



Tulsa's new 20-story First National Building promises to be one of the city's most impressive structures. It is to contain shops on the street level, a spacious lobby, a mezzanine, four stories devoted to banking facilities, fifteen stories of office space, and a penthouse. It will have eight elevators, and its escalators will be capable of handling up to 5000 people per hour.

The air-conditioned structure occupies a 100 ft x 140 ft corner plot and contains both a basement and sub-basement. The first-floor interior columns are to be covered with stainless steel. The second story will be faced with fixed glass and Georgian marble, and gray glazed brick, with marble trim, will be used for the remainder of the building.

Construction of Tulsa's attractive First National Building called for the fabrication and erection of 2889 tons of steel, all of which was handled by Bethlehem.

Architects: Carson & Lundin, New York.
Consulting Engineers: Edwards & Hjorth, New York.
General Contractor: Manhattan Construction Co., Muskogee, Okla.
Owner's Representative: John W. Harris Associates, Inc., New York.

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FABRICATED STEEL CONSTRUCTION

BETHLEHEM STEEL

(Continued from page 80)

Calif., died recently at the age of 74. In 1914 Mr. Dodson became connected with the California Electric Power Co. (then the Southern Sierras Power Co.) as an engineer. He handled construction of the company's Gem Dam and Rush Creek plants, and later was in charge of its five hydroelectric plants at Bishop Creek. He went to Riverside in 1918 as general superintendent of the company, and was made vice-president in 1922 and general manager in 1929. Earlier in Mr. Dodson's career he was with the Oregon Power & Light Co., at Portland, and with the Pelton Water Wheel Co. in San Francisco.

Earl Conarroe Elliott (Aff. '24) district engineer for the Smaller War Plants Corp., San Francisco, Calif., died on June 6, 1949, according to recent word. He was 74. An authority on water problems, Mr. Elliott had been secretary of the Muncie, Ind., Water Co.; vice-president and superintendent of the Wichita, Kans., Water Co.; and president of the California Water Service Co. and the Oregon-Washington Water Service Co. For several years he was city manager of Wichita.

Walter Scott Gearhart (M. '14) manager of the Standard Concrete Pipe Co., Springfield, Ill., died suddenly on January 7. He was 70, and a graduate of the University of Missouri. Mr. Gearhart's experience included positions as assistant highway engineer for the Illinois State Highway Commission; state engineer of Kansas; and manager of the Illinois Limestone Co. Since 1931 he had owned and developed the Standard Concrete Pipe Co.

James Bell Girand (M. '12) consulting engineer of Phoenix, Ariz., died last April. Mr. Girand, who was 75, had had a consulting practice since 1931, specializing in geology and mine examination. Earlier he had been chief engineer of the Gila Water Co. in charge of design and construction of Gila Dam; consultant in charge of a proposed $35,000,000 hydroelectric development on the Colorado River to furnish power for various mining companies; and technical consultant to the Government of Chile on a public works program. In the latter capacity Mr. Girand directed the geological investigation of some 30 dam sites and design and construction of Recoleta Dam, said to be the largest earthfill dam in South America. He was educated at Texas A. & M. College.

John Fellows Gowen (Assoc. M. '23) secretary-treasurer of Sperl, Gowen & Gregory, Inc., New York, N. Y., died at his home in Dobbs Ferry, N. Y., on November 10, at the age of 59. For a number of years following his graduation from Harvard University in 1911, Mr. Gowen was a member of the Ossining, N. Y., architectural firm of Applebee & Gowen. He was also architectural engineer for the Copper & Brass Research Association in New York, and more recently had been construction engineer for the Mutual Life Insurance Co. there.

Lewis John Henry Grossart (M. '07) consulting engineer of Allentown, Pa., died on December 27, at the age of 83. Mr. Grossart had been town engineer for a number of Pennsylvania communities and city engineer for Allentown. Since early in the century he has intermittently been in private practice in Allentown and Bethlehem, Pa.,—for the past 20 years with his son, Lewis Phaon Grossart, Assoc. M. ASCE. He had also been highway engineer for Lehigh County. He was a graduate of Lehigh University.

Harry Comings Hodgman (M. '10) retired engineer of Waukesha, Wis., died in a hospital at Pomona, Calif., on December 31. Mr. Hodgman, who was 78, spent his entire career in the civilian service of the Army Corps of Engineers. He was connected with the building of the Livingstone Channel on the Detroit River, and for many years was in charge of various areas of Missouri River flood control work. He spent his final years in the Los Angeles District office, where he supervised flood-control work on the Los Angeles River and the building of Army airports throughout the Southwest in World War II. Since his retirement in 1943 he had made his home in Waukesha, spending his winters in California or Florida. Mr. Hodgman was educated at Michigan State College and the University of Michigan.

Clarence Boal Hoover (M. '27) city water works superintendent of Columbus, Ohio, died on November 5, at the age of 68. A graduate of Ohio State University, Mr. Hoover spent most of his career in the Columbus Engineering department—for a number of years as chemist in charge of operation of the sewage-treatment works and pumping stations. Following service in the Construction Division of the Army in World War I, he became engineer in charge of the Bureau of Water Works Extension, and later was made superintendent of the water and sewage-disposal divisions.

Clarence William Hubbell (M. '04) retired consultant of Detroit, Mich., was struck and killed by an automobile in Novi Township on February 1. He was 79. Except for a seven-year period as chief engineer of public works for the Philippine Islands, Mr. Hubbell spent most of his career in the service of the City of Detroit. In the successive positions of civil engineer in charge of the Water Department, city engineer, and consultant to the city, he played an important role in planning the city's present water system and in planning and directing construction of its $40,000,000 modern drainage and sewer system. Since 1916 Mr. Hubbell had also maintained a private practice in Detroit—from 1932 until his retirement in 1947 as a member of the firm of Hubbell, Roth & Clark, Inc., which advised on several important Wayne County improvement projects, on large Army Engineer projects in World War II, and on such industrial projects as water supply and sewage treatment facilities for the Willow Run Bomber Plant. In 1902 Mr. Hubbell received the Society's Norman Medal for his joint authorship of a paper recording original investigations on laws governing the flow of water in pipes and bends. He was a graduate of the University of Michigan and a member of many professional societies.

William Stephen Menden (M. '06) who was connected with the construction and contracting firm of E. W. Foley, Inc., Brooklyn, N. Y., died recently. He was 81. A graduate of Rose Polytechnic Institute, Mr. Menden was for many years connected with the Brooklyn Rapid Transit Co., which he had served as chief engineer and president. Later he was president of the Brooklyn-Manhattan Transit Corp.

George Earl McCurdy (Assoc. M. '13) designing engineer in the Dade County Engineer's Office, Miami, Fla., died on August 8, according to word just received at Society Headquarters. He was 65. A graduate of Cornell University, Mr. McCurdy spent his early career with the Pennsylvania Railroad Lines west of Pittsburgh. Later he was with the Marquette Construction Co., of Chicago, in charge of the construction of sewer systems for various municipalities, and more recently had been manager of Robert & Co. Associates, Inc., Miami.

Robert Edward Moss (M. '19) for some years a civil and topographical engineer and surveyor in the New York City Municipal Department, died at his home at Glen Ridge, N. J., on January 19. He was 78. For over 35 years Mr. Moss had his own engineering practice in New York. He had made his home in Glen Ridge since 1896 and was influential in the planning of the community as a residential development and in other civic affairs. He held engineering and architectural degrees from New York University.

George Gordon Pollock (Assoc. M. '12) president of the George Pollock Co., Sacramento, Calif., died suddenly at his home there on January 15, at the age of 64. As head of his own engineering and construction company since 1918, Mr. Pollock had been engaged on the construction of many outstanding Western projects, including Shasta Dam and the All-American Canal, and large Navy bases and dry docks at Alameda, San Pedro, and Mare Island, Calif., and Pearl Harbor. During the recent war he headed the Pollock Stockton Shipbuilding Co., which was credited with constructing more than $80,000,000 worth of naval auxiliary vessels. Mr. Pollock belonged to many professional societies, and his civic activities included leadership in Boy Scout and Masonic work. Among his avocations was large-scale cattle farming.

George Garnett Shedd (M. '15) civil engineer of Manchester, N. H., died on August 31, according to word just received at Society Headquarters. Mr. Shedd, who was 76, was president and general manager of L. H. Shattuck, Inc. of Manchester, for many years. Earlier in his career he was with the late John R. Freeman, Past-President and Honorary Member of ASCE, on several New England projects, and with J. G. White & Co., of New York.

Charles Herman Snyder (Assoc. M. '06) retired engineer of Oswego, N. Y., died there on January 19, at the age of 70. A civil engineering graduate of Cornell University, class of 1902, Mr. Snyder was initially employed by the Cambria Steel Co., of Johnstown, Pa. For much of the period between 1904 and his retirement in 1946 Mr. Snyder served as city engineer of Oswego, working on numerous street, bridge, sanitary engineering, and other improvements for

the city during this period. For six years he was with other organizations—the Monarch Engineering Co., of Buffalo, and Syracuse division office of the New York State Highway Department.

Alfred Allen Stuart (M. '91) retired engineer of Winter Park, Calif., died April 11, 1948, according to recent notification. He was 93, and an alumnus of Rensselaer Polytechnic Institute. A specialist in heavy bridge masonry, Mr. Stuart had been resident engineer on a masonry bridge across the Ohio at Cincinnati, and on masonry work on two St. Lawrence River bridges and on the Williamsburg Bridge over the East River between Manhattan and Brooklyn. He retired in 1917.

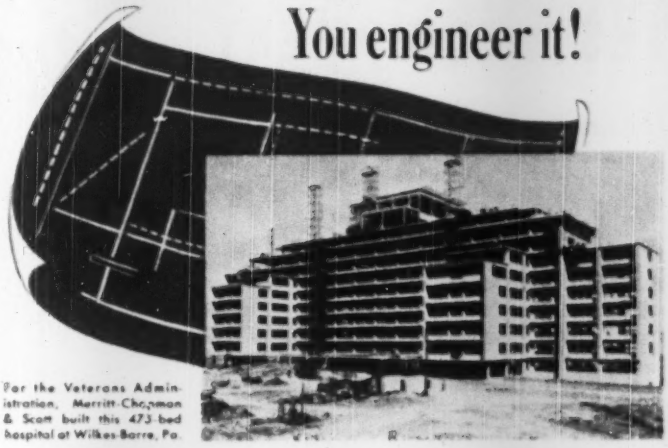
Ralph Danford Thomas (M. '14) for many years president of the Minneapolis, Minn., consulting engineering firm of Ralph D. Thomas & Associates, Inc., died in that city on December 16. Mr. Thomas was at one time hydraulic engineer for the St. Anthony Falls Power Co. His home was in Wayzata, Minn.

Cornelius Clarkson Vermeule (M. '21) retired consulting engineer of New Brunswick, N. J., died in a hospital there on February 1, at the age of 91. An authority in the field of water supply, Mr. Vermeule maintained a consulting practice in New York City from 1888 until his retirement in 1943. His work included the design and construction of municipal water systems and hydroelectric and steam power plants throughout the country. His clients included the government of Cuba and many corporations. Mr. Vermeule held several degrees from Rutgers University, and was author of numerous professional works.

Thomas R. C. Wilson (M. '45) retired chief of the Division of Timber Mechanics of the Forest Products Laboratory, Madison Wis., was fatally stricken on a train trip on January 10. He was 65. An authority on the engineering properties of wood and wood structures, Mr. Wilson retired from the Forest Products Laboratory staff in 1946 after 36 years of research and other work in the U.S. Forest Service. Since his retirement he had been engaged in consulting work for industrial concerns in Madison and the Pacific Northwest and for the National Lumber Manufacturers' Association in Washington, D.C. Of recent years he had specialized in the field of laminated structural members. Mr. Wilson was a graduate of Purdue University.

Thomas R. C. Wilson

William Kirk Wyatt (M. '30) construction engineer for the Reading Railway, Philadelphia, Pa., died on January 14, at the age of 59. Mr. Wyatt spent his career with the Reading Railway, for which he built a number of railway bridges in the Philadelphia and Atlantic City area. These structures include a four-track, eight-span concrete arch bridge over the Schuylkill River in Fairmount Park, and a seven-span bridge with deck-girder approach at Atlantic City. His home was at Lansdale, Pa.



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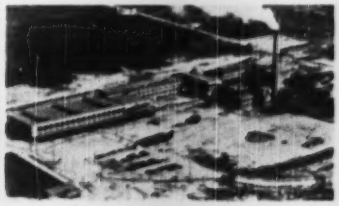

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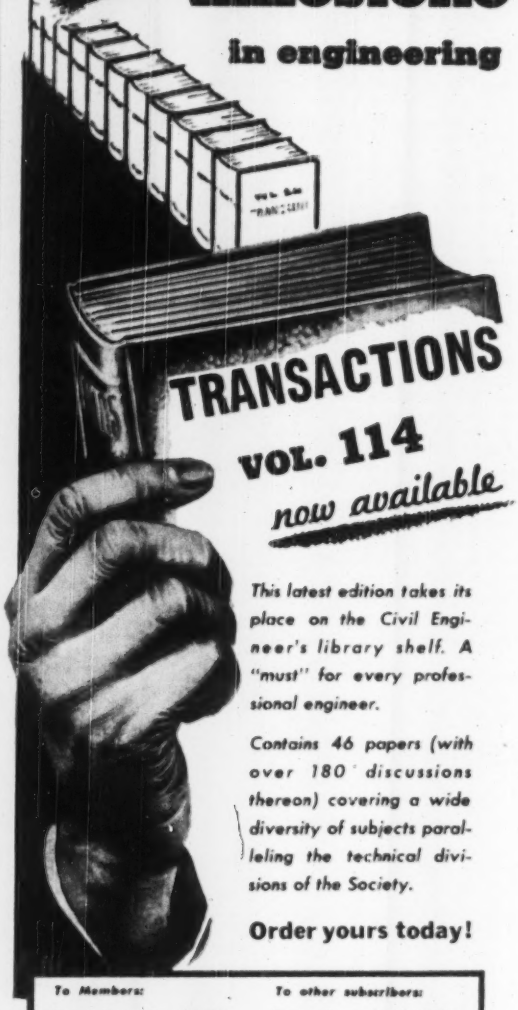

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New Publications

Highway Research. Recent publications of the Highway Research Board include Bulletin No. 19, consisting of eight papers on various phases of the parking problem that were presented at the 28th annual meeting of the Board; Research Report No. 8-F, which gives the results of four field experiments conducted by the State Highway Departments of Illinois, Kansas, and Nebraska, and by the City of Little Rock, Ark. to evaluate the effectiveness of bituminous materials in retaining moisture in soil cement for seven days following construction; a revised edition of Bulletin No. 8-R, which discusses the thickness of flexible pavements in the Current Road Problems series; and a Progress Report of the Project Committee on Maintenance Costs, dated December 1949. Inquiries should be addressed to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

Beach Erosion. Results of experimental study of the reflection of solitary waves conducted in the laboratory of the Beach Erosion Board are set forth in Technical Memorandum No. 11 issued by the Board. Purpose of the study is to determine the several variables controlling the amount of wave energy reflected by representative beach or shoreline structures, and to derive a basic formula incorporating these variables. The study was made by Joseph N. Caldwell, Assoc. M. ASCE, Lisle H. Senser, Jr., and others of the laboratory staff. Inquiries should be addressed to the Beach Erosion Board, Office of the Chief of Engineers, Washington, D.C.

Smoke Research. A pamphlet describing work on smoke research that is being carried on in a new low velocity wind tunnel in the New York University College of Engineering may be obtained without charge by writing V. W. Palen, New York University, University Heights, New York 53, N.Y.

Radioactive Wastes. The safe handling of radioactive wastes in the atomic energy program is treated in a 30-page brochure, recently issued by the Atomic Energy Commission. Included also are details of the AEC's extensive research program to improve waste handling and storage methods. The report, which is entitled *Handling Radioactive Wastes in the Atomic Energy Program*, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., at 15 cents a copy.

Examinations for Registration. A completely revised edition of *California Civil Engineer Registration Examinations* is available from the author, August E. Waegemann, Jun. ASCE, 2833 Webster Street, San Francisco 23, Calif., at $5 a copy. Included in the 162-page lithographed publication are all the examination questions and solutions given by the California State Board of Registration for Civil Engineers from 1940 to 1949; new engineer-in-training examinations and solutions; and the text of the California Civil Engineers Act and the Professional and Vocational Regulations.

Home Construction. Methods of controlling destructive condensation in compactly built small homes are described in a 72-page illustrated pamphlet, *Condensation Control in Dwelling & Construction*, published by the Housing and Home Finance Agency. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C., at 20 cents each.

Surveying. For the convenience of surveyors and instructors in engineering astronomy, the Keuffel & Esser Co., has issued a revision for 1950 of its handbook on *Solar Ephemeris*. The revision, which was prepared by Philip Kissam, M. ASCE, professor of civil engineering at Princeton University, incorporates complete data on computing the hour angle of Polaris by civil rather than sidereal time; material required for observations on 18 of the best navigational stars, in addition to Polaris and the sun; and complete stadia tables for computing the horizontal and vertical components of inclined stadia sights.

Bridges, Chicago. To commemorate the opening to traffic of the $1,000,000 East 130th Street fixed bridge over the Calumet River in Chicago, the Chicago Department of Public Works has issued a descriptive bulletin. The publication includes interesting illustrations of past and present bridges over Chicago rivers, which are now spanned by a movable bridge system called the most complete in the world. Inquiries should be addressed to the Department of Public Works, Bureau of Engineering, Chicago 2, Ill.

Water Supply. *California's Stake in the Colorado River* is the title of a 23-page bulletin recently made available by the Colorado River Board of California. According to the Board, about 5,500,000 acre-ft of Colorado River water will be required annually to meet industrial and other needs in Southern California. Works and facilities already constructed or in process of construction are outlined in the bulletin, which also summarizes legislation involved in development of the Colorado River, water and power contracts, and problems of allocation. A limited number of copies are available without charge from the Colorado River Board, 315 South Broadway, Los Angeles, Calif.

Navy Personnel. Employment opportunities in the Navy Department for engineers, scientists, and technicians are listed and described in a 90-page *Scientific Personnel Bulletin*, issued by the Office of Naval Research. The Bulletin, which is identified as NAVEXOS P-513, also includes a general section on the way to go about getting a Civil Service appointment in the Navy, the advantages of employment in the Navy's research program, and the general employment requirements. Inquiries should be addressed to the Office of Naval Research, Navy Department, Washington 25, D.C.

Stream Flow. An analysis of all streamflow records in Ohio made by means of daily-flow duration tables calculated at half-decade intervals, has been issued as Part I of Bulletin 10 by the Department of Natural Resources, Division of Water. Wide variations in flow duration value for different streams are explained in relation to soil and geology within the basin. Part II of the bulletin, now in preparation, will consist of a series of curves, one for each gaged area, which will indicate on a unit basis the artificial storage volume required to sustain various rates of flow. Copies of Part I are available now at cost ($1 each) from the Department of Natural Resources, Division of Water, Administration Building, Ohio State Fairgrounds, Columbus 3, Ohio.

Materials Handling. A comprehensive bibliography on pallets used in modern materials handling has been compiled by the Engineering Societies Library and issued as ESL Bibliography No. 4. Listed are 114 books and articles, covering the period from 1937 to date, on all aspects of pallets, including design and construction of the different types, the handling of various materials on pallets, the savings achieved in materials handling, and details of present-day applications in industry. Bibliography No. 4 may be purchased from the Engineering Societies Library, 29 West 39th Street, New York 18, N.Y., at $2 a copy.

(Continued on page 92)

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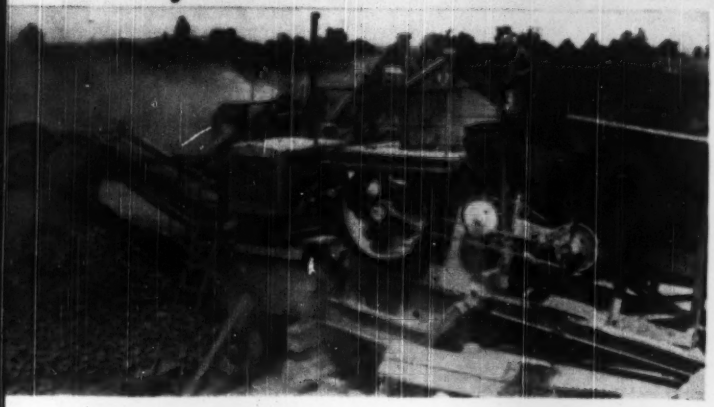

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Men Available

HYDRAULIC ENGINEER. Assoc. M. ASCE. 47, native American, with teaching experience, seeks professorship in school desiring to develop hydraulics laboratory for regional problems. Can teach mechanics and vector analysis gladly. Executive and administrative experience. Speaks German and French. Author of numerous technical publications. Will locate anywhere. Creative opportunity, not salary, governing. C-563.

CIVIL AND STRUCTURAL ENGINEER. Assoc. M. ASCE. 40, married, licensed P.E. Civil—Kansas, Structural—Illinois. Nine years' military service including 2 years' military construction in United States, a year in Alaska, remainder in command, administration, planning, and training; 8 years' highway bridge design in Kansas and North Dakota; 5 years highway survey, design, construction, Illinois and Kansas; and 2 years' structural timber design. Available April 1, 1950. C-564—123CE.

CIVIL ENGINEER? Jun. ASCE; licensed New York and New Jersey; 4 years experience teaching engineering structures; 7 years' varied design; desires appointment as Assistant or Associate Professor. Available in June. C-565.

CIVIL ENGINEER. M. ASCE. 30; single; graduate, University of Wisconsin; 3 years experience structural analysis, 3 years' supervision of general construction utilization of heavy construction equipment, maintenance of structures and grounds, including substantial administration; fluent German; desires overseas position or one requiring considerable travel outside United States; available immediately. C-566.

CIVIL ENGINEER. Jun. ASCE; 28; graduate. Varied experience as field layout engineer and foreman on heavy construction. Cost conscious, responsible, ambitious. Desires permanent connection as construction engineer with firm engaged in foreign work. C-567.

CIVIL ENGINEER. Assoc. M. ASCE; registered; 43; married; B.S. C.E.; graduate study in sanitary engineering; 20 years' varied experience in engineering teaching, highway location and construction, geodesy, hydraulic and sanitary engineering. Desires permanent position of responsible character. C-568.

SANITARY ENGINEER. Student M. ASCE; B.S. in C.E.; completing work on M.S. in sanitary engineering; 26; married. Speaks Spanish, his mother language; knowledge of Portuguese and French. Desires position in public health, water supply or water treatment. Willing to locate anywhere, but prefers South or Central America. Available May 1, or sooner. C-569.

PETROLEUM ENGINEER. Jun. ASCE. 23. Graduate, B.S. in C.E., 2 years inspection engineer with major oil refinery on unit equipment, piping and tanks; a year with highway department on highway and bridge construction. Desires position with refinery engineering. Salary, $350-$400 a month. Will locate anywhere. C-570—209CE.

CIVIL ENGINEER. Jun. ASCE. B.S. in C.E., 28, married. 2 years construction, 2½ years structural detailing and checking, and a year highway design office experience. Desires position in maintenance or field engineering. Available on short notice. Prefers the east. C-571.

Positions Available

CIVIL ENGINEER, graduate, with broad experience, a substantial portion of which has been in hydraulics. Excellent opportunity with a large public utility. Apply by letter stating education, experience, and salary requirements. Location, eastern Pennsylvania. Y-2413.

DESIGN ENGINEER, under 35, with at least 4 years' experience in design and construction of county roads and bridges, to design and lay out new, and improvements to, highway bridges and approaches. Must have New York State License. Salary $4,200-$4,800 a year. Location, upstate New York. Y-2925.

SANITARY ENGINEERS. (a) Sanitary Engineer, Graduate, with 10 to 15 years' experience in water distribution and sewerage systems, waterworks and sewage treatment plants, dams, reservoirs, etc., for consulting engineering firm. Must have construction experience, thorough knowledge of sanitary design and be capable of directing drafting room work. Salary dependent on qualifications. (b) Assistant Sanitary Engineer, graduate, with 3 to 5 years' experience in sewerage systems, waterworks, etc., to direct work of small squad of draftsmen and/or junior engineers in sanitary design. Salary dependent on qualifications. Location, Pennsylvania. Y-2936.

CIVIL ENGINEER, graduate, with at least 12 years' experience, to supervise project engineers on building work, waste disposal and structural design, for chemical company located in the east. Scheduling experience also desirable. Write stating experience, education and salary requirements. Y-2970.

PROFESSOR in sanitary engineering, with advanced degrees, to develop sanitary engineering program and to head department of civil engineering. Experience in engineering practice and in research essential. Location, East. Y-3007.

ASSISTANT ENGINEER, 30-40, civil graduate with at least 5 years' experience in municipal design construction, and maintenance, to assist resident engineer and manager in charge of utility construction program consisting of telephone system, power plant, water-treatment plant, steam electric, and water-distribution systems. Salary $7,000-$10,000 a year. Location, Alaska. Y-3018CS.

RESIDENT ENGINEER, 45-55, civil or architectural graduate, with general building and concrete construction experience, to act as clerk of the works for architect interpreting plans and specifications, checking quantities, etc., on municipal project. Salary, $6,500 a year. Location, Bronx, N.Y. Y-3032 Reopened.

CONSTRUCTION ENGINEER with contact experience in the South, covering industrial buildings, to solicit business for steel and concrete structures. Salary, approximately $5,000 a year. Location, Southeast. Y-3186.

CONSTRUCTION ENGINEERS over 40, for irrigation and allied work. Experience desired in drainage and reclamation, water supply and flood protection, hydroelectric and harbor engineering. Some administrative experience desirable. Three-year contract. Salary 1,500 pounds sterling a year. Location, Ceylon. Y-3192.

PROFESSOR in civil engineering with advanced degrees and experience, to head department of civil engineering. Primary interest should not be in structural engineering. Location, Mid-South. Y-3228.

PARTNER OR ASSOCIATE CONSULTING ENGINEER for consulting firm in eastern Rocky Mountain region. Must be capable and experienced. Cash equity required to demonstrate intent. Practice is in municipal engineering, industrial and private building, and general civil, structural and architectural work. Y-3233.

CITY MANAGER, 30-45, with extensive experience in municipal engineering, city planning, public works. Must be a good administrator. Knowledge of Hebrew desirable. Salary, $7,000-$10,000 a year. Location, Foreign. Y-3237.

SANITARY AND HYDRAULIC ENGINEER with at least 10 years' experience in the designing of sewage and water systems, sewage-treatment plants, water-treatment plants, reservoirs, dams, and miscellaneous sanitary and hydraulic municipal projects. Work also includes investigations, studies, and reports for consulting firm. Location, Massachusetts. Y-3279.

STRUCTURAL DESIGNER, graduate C.E. up to 55, extensive experience in steel or steel and concrete on heavy industrial installations. Salary, $500-$550 a month. Location, Illinois. R-6196-(a).

STRUCTURAL ENGINEER (research) graduate or advanced degree. Practical experience with structural analysis, knowledge of dynamics, informed about plasticity, strength of materials beyond the plastic range. Will resolve theoretical structural problems, dealing with vibration of structurals. Precisely stated problems furnished for appropriate mathematical analysis to arrive at final decisions based on practical assumptions. Salary open. Location, Illinois. R-6203.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $1.50 per quarter or $12 per annum, payable in advance.

OPPORTUNITIES WITH THE CITY OF DAYTON

Sewer Design Engineers. At least four years of graduate civil engineering experience with experience on municipal sewer systems preferred. For work on extensive sewer survey and design projects with the City of Dayton. Registered in the State of Ohio or eligible for such registration. Starting salary $3600 to $5000, depending on qualifications. Apply with full details and photograph to Personnel Supervisor, Municipal Building, Dayton, Ohio.

SALES ENGINEERS, experienced in the sale of industrial products to industry, public works, and utilities. Will promote sale of water proofing and rust preventive chemicals and develop Chicago regional sales; potential sales manager. Salary open. Location, Illinois. R-6224.

CONSTRUCTION SUPERINTENDENT, C.E., 35–45, minimum 10 years' experience as contractor's superintendent on industrial type buildings. Must be able to run complete job and work with architects, owners, contractors, etc., for a general contracting construction company. Salary, $7,500–$9,000 a year. Location, Illinois. R-6236.

STRUCTURAL DESIGNER-CHECKER. C.E. or equivalent. Well experienced in checking designs and details of heavy structural steel and reinforced concrete as encountered in chemical plants, involving structures, tunnels, bins, conveyors, bridges, etc. Salary, $6,000 up. Location, Illinois. R-6237.

CIVIL ENGINEER. Associate Hydraulic Engineer to plant, design and supervise major flood-control projects. California license and 3 years' experience desired. Merit-System pay and retirement benefits. Salary, $417–$516 a month. Location, California. S-871.

Meetings and Conferences

American Society of Mechanical Engineers. The spring meeting of the American Society of Mechanical Engineers is scheduled for the Hotel Statler, Washington, D. C., during the week beginning April 10.

Construction Industry Advisory Council. Technical sessions of the Construction Industry Advisory Council—established in 1945 by the U. S. Chamber of Commerce and composed of national trade and professional associations with a major interest in construction—will be held in Room A of the National Chamber Building, Washington, D.C., March 21. Address inquiries to James R. Edmunds, Jr., Council chairman, 1615 H Street, N.W., Washington, D.C.

Earthmoving Industry Conference. The first Earthmoving Industry Conference will be held in Peoria, Ill., April 11–12. Further information may be obtained from Russell W. Rand, Publicity Chairman, R. R. #2 Hamilton Road, Peoria, Ill.

Midwest Power Conference. Economy in power will be the theme of the 12th annual Midwest Power Conference, which is sponsored by the Illinois Institute of Technology with the cooperation of other midwestern universities and local and national engineering societies at the Sherman Hotel, Chicago, Ill., April 5–7. Inquiries should be addressed to Conference Secretary Edwin R. Whitehead, Illinois Institute of Technology, Technology Center, Chicago 16.

National Association of Corrosion Engineers. Headquarters for the annual convention and exposition of the National Association of Corrosion Engineers will be the Jefferson Hotel, St. Louis, Mo., April 4–7.

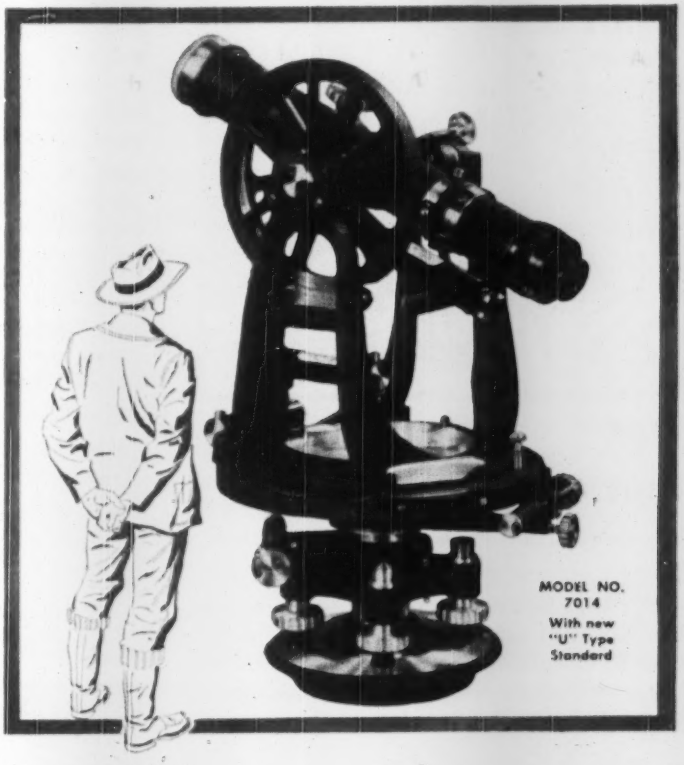
Second Inter-American Sanitary Engineering Congress. Sanitary engineering programs and inspection tours have been arranged for the Second Inter-American Sanitary Engineering Congress to be held in Mexico, D.F., March 16 through 24.

Society of Automotive Engineers. Technical sessions of the Society of Automotive Engineers and allied sessions are to take place at the Hotel Book-Cadillac, Detroit, Mich., March 14–16.

Have you seen the important

NEW FEATURES

on the WHITE Engineers' transit



YES, the White Engineers' Transit is a fine engineer's instrument — now made even finer with the addition of *covered leveling screws* and *coated optics*.

Covered leveling screws assure you of smooth, easy, precise leveling at all times, under all kinds of conditions for the life of the instrument itself.

Coated optics guarantee clear, sharp, accurate images — without halation, at longer distances, even under adverse conditions.

Compare the David White Engineers' Transit with all others—feature for feature — price for price. Compare them for accuracy — long durability — built-in quality. To meet your preference, this instrument is available with "U" or "A" type standards. You'll find you'll buy right when you buy a David White.

Contact our nearest dealer for complete details of the David White Engineers' Transit and for other fine Engineering Instruments—or write direct to David White, 359 W. Court St., Milwaukee, Wis.

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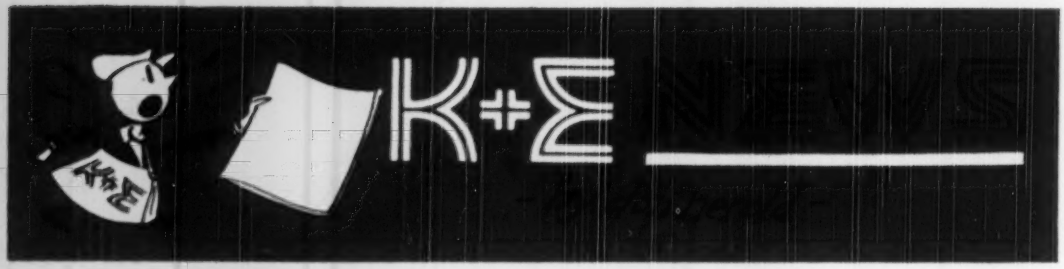
We offer complete, prompt repair service on all makes of instruments — levels, transits, theodolites, etc.



tape that can take it

You don't exactly buy tape to kick it around,

BUT—

—BUT you'll have to admit that most woven tapes do have to take an awful beating. For years nobody has come up with a better answer than "metallic" woven tapes—with little strands of metal woven into them.

BUT here's something far better—PHOENIX WYTEFACE† *non-metallic* Woven Tapes—a great and radical forward stride in tape development.

As one highway engineer puts it: *"it has at least three times the life of ordinary metallic tapes."*

PHOENIX WYTEFACE has been given the works in grueling field tests—in extremes of climate, in water and mud, over stones and rocks, under truck wheels, through brush and barbed wire—and has come through shining and unscathed.

The secret is, this tape is a weave of amazingly strong synthetic yarns—a scientific wartime development—completely covered by an armor-like plastic coating that is not affected by water, is not brittle, will not flake.

MORE ACCURATE, TOO

Even after repeated soaking and dryings, this tape won't let you down. It has dimensional stability a lot greater than so-called "metallic" woven tapes.

And it has a HIGHER DIELECTRIC CONSTANT—which is important to power and utility companies and to anyone working near high tension circuits.

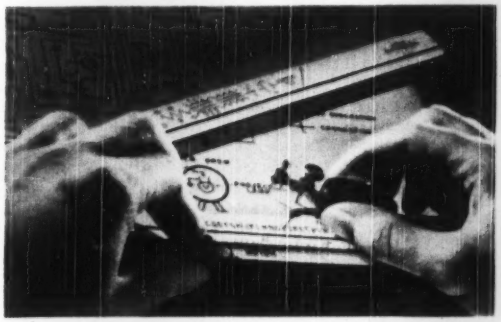
The clear black and red markings on the white background almost read themselves out loud, and the surface easily wipes clean as a whistle.

†Trade Mark. U. S. Pat. 2,031,989.

PHOENIX WYTEFACE

beautiful lettering with little effort

Many engineers make perfect drawings and then mess them up with "home made" lettering. A quick easy way to get lettering and symbols which look like type on your drawings is to use a LEROY* "controlled lettering" outfit, a Keuffel & Esser Co. product.



THE MAN WHO HAND LETTERED THIS LINE

DID THIS WITH A LEROY LETTERING SET.

And he had had little experience with LEROY, and it took him no more time.

He didn't even have to rough it in with a pencil or draw guide lines. He chose one of several alphabets (templates) in his kit and followed the character grooves with an easy stroke of the scriber. Then the pen formed perfect letters right where he wanted 'em. A blind man could darned near do it!

LEROY lettering is free from risk of smearing, because the template is well removed from the lettering, and, there's no need for erasing. You have a wide choice of sizes and types of lettering, numerals and symbols.

a tracing paper for the ages

You practically want to think of posterity when you buy tracing paper. Well, there are drawings around today that were made years and years ago on ALBANENE*, and they are today as crisp and sharp as you could ask—which proves that ALBANENE does not turn brittle or lose its transparency with time.

You see, ALBANENE's transparency is due not to oils that leak and "bleed", but to a synthetic transparentizer that K&E developed specially for this purpose—and not for flavoring popcorn.

*Trade Mark ®

Ask your K&E Distributor or Branch for further information on any of these fine products, or for a sample length of PHOENIX WYTEFACE. Or write to Keuffel & Esser Co., Hoboken, N. J.

K&E
partners in creating
For 73 years K&E equipment and materials have been partners of the draftsman, engineer and scientist in shaping the modern world.

Now in use on one of the largest architectural concrete construction jobs in the United States

New architectural and engineering techniques are being pioneered on the Metropolitan (Parklabrea) Housing Project in Los Angeles.

VIBER SELECTED...One of the five unusual features of this tremendous project is an effort to reduce time, effort and costs in concrete placement operations. The exclusive use of Viber equipment on a project that is testing new construction methods and techniques illustrates the regard engineers and construction men have for this interchangeable line of concrete vibrators.

VIBER RUBBER TIPS...Viber's development of rubber tips has reduced damage to expensive forms ... an important phase of architectural construction costs.

GOVERNMENT AND RESIDENTIAL HOUSING...The vast program of Government and residential housing now in planning and process is just one of the fields in which Viber plays an important roll.

For further information on the complete line of Viber Interchangeable Vibrators, please wire or write

$40,000,000 Parklabrea Housing Project, Los Angeles

VIBER COMPANY *CONCRETE VIBRATORS SINCE 1931*
Dept. 18, 726 South Flower Street, Burbank, California.

(Continued from page 86)

Flow Meters. All phases of flow engineering are treated by L. K. Spink in a revised and enlarged edition of his handbook, *Principles and Practice of Flow Meter Engineering*. The present edition, the seventh since the book was first published in 1930, includes a new section by R. L. Parshall, Assoc. M. ASCE, inventor of the Parshall Flume, giving design details, operating instructions, and tables for measuring flow through open channels by means of weirs and flumes. The 416-page illustrated handbook sells for $7, upon application to the Foxboro Co., Foxboro, Mass.

Technical Dictionary, French. Publication of a French-English and English-French glossary of terms involved in the operation, maintenance, and repair of construction equipment is announced by the Institut Technique du Batiment et des Travaux Publics. Prepared primarily to fill the need for a technical dictionary encountered by French engineers and builders in overseas work, the 184-page publication includes tables to facilitate conversion from British to metric units and vice versa. Copies bound in cloth are on sale at the Institut Technique du Batiment et des Travaux Publics, 28 boulevard Raspail, Paris, France, for 700 francs bound, plus postage.

Value of Technical Competence Emphasized

(Continued from page 50)

to those who may never reach the top rung of the promotion ladder, it is suggested that consideration also be given to the advertisement on page 107 of the same issue of CIVIL ENGINEERING. This advertisement reports authoritative conclusions with respect to personal characteristics most desirable for an engineer, listed as follows in order of importance:

1. Intelligence
2. Dependability
3. Organizational acceptability
4. Energy
5. Emotional acceptability
6. Physical acceptability

An engineering or construction organization that is manned 100 percent by potential vice-presidents can be imagined. No doubt it would be better to have about 99 percent of the outfit composed of people who are technically proficient in handling their assignments.

Engineers deal with the forces of nature, which are unresponsive to personal charm in any amount.

This comment is not intended to belittle desirable human qualities but rather to suggest that appreciation is due the technically competent in the engineering profession.

A. H. DAVISON, M. ASCE
Civil Engineer
Glens Falls, N.Y.

Recent BOOKS

DIE GESCHICHTE DER BAUINGENIEURKUNST. By H. Straub. Verlag Birkhäuser, Basel, Switzerland, 1949. 285 pp., illus., diagrs., maps, tables, 8¹/₄ × 6 in., linen bound, 22.50 Sw. Frs. A history of construction from antiquity to modern times. The contributions of notable early engineers are discussed, including the work of Archimedes, Leonardo da Vinci, Galileo, Coulomb, and Navier. Roads, aqueducts, canals, bridges, and buildings are described. Construction materials from stone through reinforced concrete are considered.

ELEMENTARY SURVEYING. 2 ed. By W. C. Taylor. International Textbook Co., Scranton, Pa., 1949. 256 pp., illus., diagrs., charts, tables, 7¹/₂ × 4¹/₂ in., cloth, $3.35. After a brief historical sketch, this basic text takes up general chaining, leveling, and traversing. Various kinds of surveying and mapping are discussed with examples. A chapter on theory of measurements presents the theoretical side of the subject. The second edition contains new problems, a brief presentation of the D.M.D. method of computing, and data on determination of meridian by sun observation.

ENGINEERS' DICTIONARY, SPANISH-ENGLISH AND ENGLISH-SPANISH. 2 ed. By L. A. Robb. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1949. 664 pp., 8¹/₂ × 5¹/₂ in., cloth, $12.50. This volume is designed to give the North American technical man the accepted engineering terminology of Spanish America and vice versa. The new edition has been enlarged. To cover more thoroughly electrical and mechanical engineering terminology, including radio and television; to bring all branches of civil engineering up to date—particularly soil mechanics, photogrammetry, and airport construction; and to include the important terms peculiar to mining, shipbuilding, logging, sugar milling, and oil-field operations.

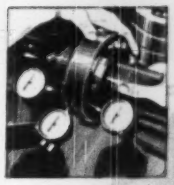
HEATING, VENTILATING, AND AIR CONDITIONING FUNDAMENTALS. 2 ed. By W. H. Severns and J. R. Fellows. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1949. 666 pp., illus., diagrs., charts, tables, 9¹/₄ × 6 in., cloth, $6.50. Intended for engineers, architects, and heating contractors, this book is also of interest to students of architectural and mechanical engineering. This second edition is revised to include the new methods of application and the equipment available. Along with applicable theory, examples of typical calculations are included. New material is presented on warm-air furnace heating, hot-water heating, panel heating, refrigeration, air purification, estimation of cooling loads, and air conditioning.

MAUERWERK, WIDERLAGER, PFEILER UND GESTALTUNG VON BRÜCKEN. 4 ed. By G. Schapter. Verlag von Wilhelm Ernst & Sohn, Berlin, 1949. 215 pp., illus., diagrs., 8¹/₄ × 5⁴/₄ in., paper, 13 DM. Of interest to structural engineers, this book discusses the form and design of stone and steel bridges. The design of brick work, abutments, and pillars is considered in detail. Over 250 pictures and diagrams illustrate the text.

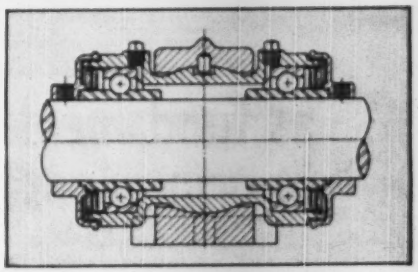
(The) MECHANICS OF ENGINEERING SOILS. By P. L. Capper and W. F. Cassie with a foreword by L. S. White. McGraw-Hill Book Co., New York, 1949. 270 pp., diagrs., charts, tables, 9 × 5¹/₂ in., cloth, $4. Based on published literature and the authors' experience, this book explains the basic principles of soil mechanics, describes the more usual tests, and introduces the reader to some of the practical applications of the subject. It is both a text for senior graduate students and a reference for practicing engineers.

PREVENTION OF IRON AND STEEL CORROSION, Processes and Published Specifications. Compiled by C. Dinsdale. Louis Cassier Co., Ltd., distributed by Iliffe & Sons, Ltd., London, Birmingham, Coventry, Manchester, and Glasgow, 1948. 88 pp., tables, 8¹/₄ × 5¹/₂ in., cloth, 5s. The object of this book is to provide a complete index of methods, processes, and standard specifications relating to the prevention of corrosion of iron and steel. The material is divided into three

(Continued on page 94)



with BALL BEARINGS — the small extra first cost of test samples pays off in assurance of efficiency and durability of the finished mechanism.



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The small extra first cost of Arkwright Tracing Cloth, over that of tracing paper, repays many times over in the efficiency and durability of valuable drawings.

Through continued research and development plus skilled manufacturing processes, Arkwright Tracing Cloths meet every requirement of exacting draftsmanship. You'll find no pinholes, stains or other imperfections to detract from drawing quality — nor smudging or feathering after repeated erasures. Most of all, you'll have highly transparent, long lasting usefulness that perishable tracing paper can never match.

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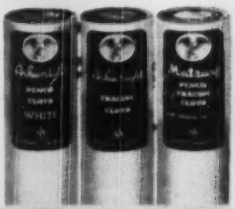

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AMERICA'S STANDARD FOR OVER 25 YEARS

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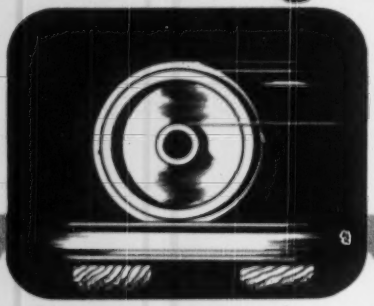
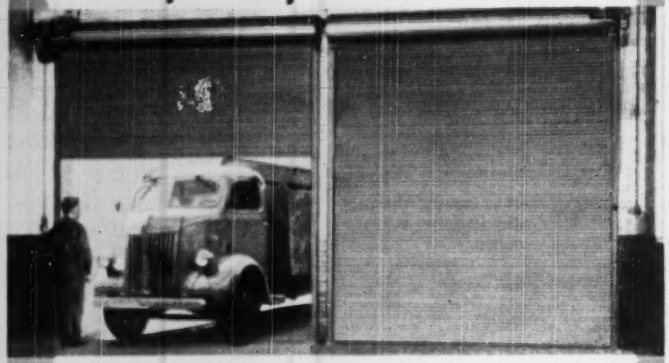


...as fundamental in principle as the wheel



Like the smooth, rolling action of the wheel, the coiling upward action of Kinnear Rolling Doors involves a basis principle of highest operating efficiency. You can change the wheel's "face" in hundreds of ways, but you can't find a better way to do its job. By the same token, the basic advantages of Kinnear Rolling Doors give you the best answer to door needs.

Kinnear's rugged curtain of interlocking metal slats opens straight upward. It coils compactly out of the way above the opening. Floor, wall and even ceiling space remain fully usable at all times. The door clears the opening from jamb to jamb, and from floor to lintel, completely out of traffic's way. When open, it is safe from damage by wind or vehicles. When closed, it presents an all-metal barrier that assures extra protection against storms, intruders, or fire.

In addition, Kinnear Rolling Doors provide smooth, easy operation under all conditions. They may be controlled manually, mechanically (by chain or crank) or electrically. Motor operated doors can be equipped with any number of remote control switches, for highest convenience. Kinnear Rolling Doors are built of various metals, in any size, for easy installation in old or new buildings. Let us send you complete information.

The KINNEAR Manufacturing Co.

1888-90 Fields Ave.
Columbus 16, Ohio

Saving Ways in Doorways
KINNEAR
ROLLING DOORS

1742 Yosemite Ave.
San Francisco 24, Calif.

Offices and Agents in All Principal Cities

(*Continued from page 93*)

parts dealing, respectively, with prevention methods, cleaning metal parts, and codes of practice. An appendix deals with paint and paint component specifications. Specifications relating to alloyed iron and steel are not included.

Books in the Engineering Societies Library may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains research and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

PRINCIPLES OF AERODYNAMICS. By J. H. Doumenil. McGraw-Hill Book Co., New York, Toronto, London, 1949. 391 pp., illus., diagrs., charts, tables, 9½ × 6 in.; cloth, $5.50. This undergraduate textbook serves as an introduction to some of the more important theoretical and practical aspects of aerodynamics. Following the development of a principle, experimental data are presented for verification purposes. In all cases, numerical examples are used to clarify explanations. Not only answers to problems, but also the most important steps required in their solution are included.

RADIANT HEATING. 2 ed. rev. and enlarged. By T. N. Adlam. Industrial Press, 148 Lafayette St., New York, 1949. 504 pp., illus., diagrs., charts, tables, 9½ × 6½ in., fabrikoid, $6. Of interest to engineers concerned with the design and installation of this equipment, this book stresses applications of radiant heating to actual problems. Both American and European design practice are considered. Step-by-step procedures are included, and typical problems are solved by the application of simplified working data, charts and tables. In this second edition, material is added to the section on panel heating, and new coil dimensioning charts are included.

REINFORCED CONCRETE. By A. L. L. Baker. Concrete Publications, Ltd., 14 Dartmouth St., Westminster, London, S.W.1, 1949. 295 pp., illus., diagrs., charts, tables, 9½ × 6½ in., linen, 15s. Beginning with the theory of statically indeterminate structures, this book continues with the analysis of various members, such as beams, slabs, columns, and struts. Prestressed concrete beams are dealt with at some length. Design procedure covers a variety of structures as well as general considerations, and includes a brief treatment of economic design. In line with the practical emphasis of the book is a short chapter on estimating, costing, and progress charts.

TECHNISCHE HYDRAULIK. By C. Jaeger. Verlag Birkhäuser, Basel, Switzerland, 1949. 464 pp., illus., diagrs., charts, tables, 9½ × 6½ in., cloth 48.50 Sw.Frs., linen bound, 44.50 Sw.Frs., unbound. Based on the author's experience in the field, this book describes the calculation methods used in the planning of hydraulic power plants. Following an introductory chapter reviewing the physical principles of hydraulics, the author presents the basic theories and equations for steady flow and shows their development and application to certain conditions. Surge chambers and the problem of water hammer are treated at considerable length. The last chapter deals with the various aspects of ground water flow.

TECHNISCHE STRÖMUNGSLEHRE. 3 ed. rev. By B. Eck. Springer-Verlag, Berlin, Göttingen, Heidelberg, 1949. 398 pp., illus., diagrs., charts, tables, 9½ × 6 in., paper, 24 DM (27 DM, bound in linen). This treatise on hydrodynamics covers the basic principles of various types of flow at considerable length, with particular attention to the influence of friction. These principles are then utilized in the analysis of blade and propeller action, airfoils, cavitation, etc. The motion of solid bodies in a flowing medium is considered, such as in dust collectors and pneumatic conveyors. There is a final chapter on flow-measuring methods and apparatus.

WELD DESIGN. By H. D. Churchill and J. B. Austin. Prentice-Hall, New York, 1949. 216 pp., illus., diagrs., tables, 8½ × 5½ in., cloth, $6.65. This concise volume considers both the practical and theoretical aspects of welded machine-base design. Construction materials and methods of processing plates and structural shapes are treated in detail. Welding technique is not considered. The appendixes contain stress-design data and a bibliography of magazine articles and books.

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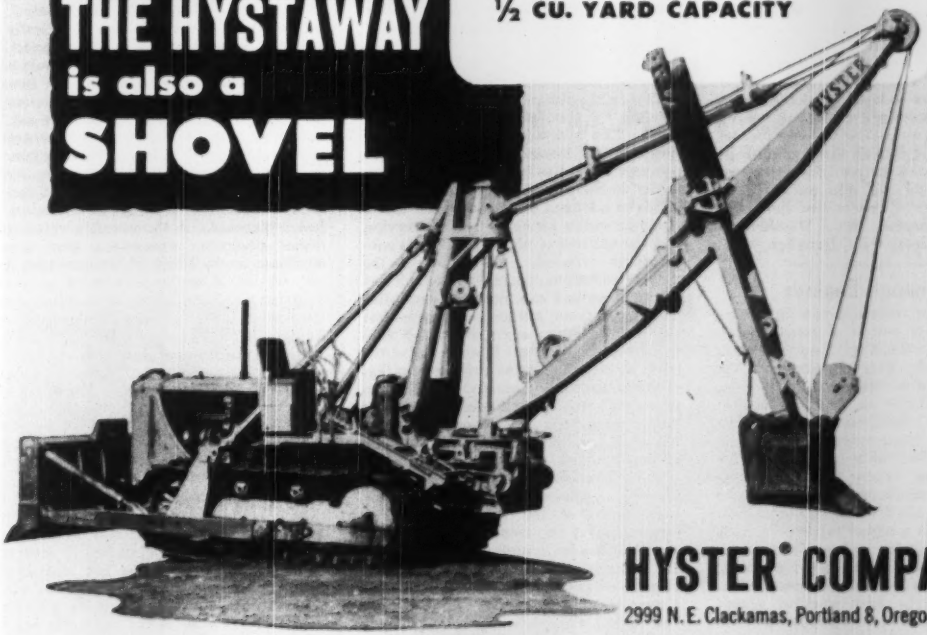

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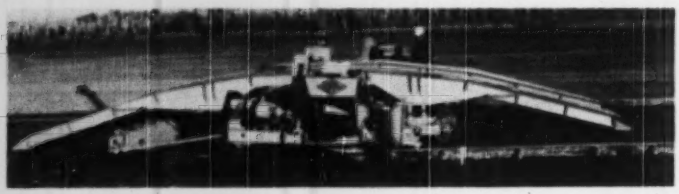
EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Vibratory Subgrader

SHOWN HERE IS THE LATEST model of the Blaw-Knox vibratory subgrader in operation on a 22 foot concrete paving job near Oskaloosa, Iowa. The contractor is Fred Carlson Company, Decorah, Iowa. This model is usable for road widths from 20 to 25 feet and is equipped with a cross-over bridge for batch trucks. The machine applies a vibratory force of 2,000 impulses per minute to the forward edge of the cutting blades. This develops great efficiency in cutting through the earth and shaving the subgrade. A method of insulation and control directs the vibrations into the ground without transmitting shock or movement into the road forms. The machine's cutting blades and strike-off are quickly adjusted for crown. The warping of the subgrade from flat to crown, or the reverse, can be accomplished without stopping the forward motion of the subgrader. Batch trucks can traverse the pass over while the machine is in motion. **Blaw-Knox Company, Blawnox, Pa.**



Water System for Pavers

A FULLY AUTOMATIC, hydraulically controlled water system is now standard equipment on Worthington-Ransome 34E Dual Drum Pavers. The system is designed to simplify operation of the machine and to assure a more uniform mix. The possibility of wet or dry batches due to carelessness is eliminated. The automatic system goes into operation when the skip is approximately 4 ft off the ground, and closes the water valves completely when the required amount of water has entered the drum. An automatic water cutoff delaying action, adjustable to a maximum of 12 sec, eliminates the need for the paver operator to hold the skip up until the proper quantity of water has been discharged. **Ransome Div., Worthington Pump & Machinery Corp, Dunellen, N.J.**

Tournapull Engines

A NEW PLAN UNDER which customers may have their choice of engine when ordering the C Roadster Tournapull has been announced. This tool now is available with either a General Motors 6-71, Cummins HBI-600 or Buda 6-DC-844 engine. The C Roadster Tournapull can be used as a prime mover for a 16 ton Carryall Scraper, or a Tournarocker, a rear dump rock wagon, or the Tournahopper, a bottom-dump hauling unit. At the same time, the C Roadster now is built for operation at a higher top speed. It is now equipped with a heavy-duty five-speed transmission with a top road speed of over 30 miles per hr in 5th gear. This machine has the four working speeds previously available (ranging from 3.0 to 19.8 mph) plus the high return speed, which can be used to good advantage in cutting down cycle time on many jobs. **R. G. LeTourneau, Inc., Peoria, Ill.**

Newly Designed Gradall

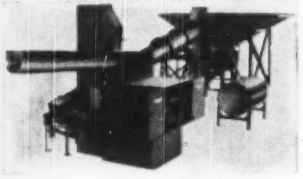
NEW DESIGN REFINEMENTS incorporated into the Gradall contribute to improved efficiency of the versatile earthmover. Width of the circular roller path around the circumference of the main turntable has been increased, permitting the use of larger bearing rollers. In addition a bogie-mounted pair of rollers has taken the place of each single tapered roller formerly used, so that eight rollers share the load formerly handled by four, providing greater stability. The hydraulic control valve manifold formerly located at the front of the operator's cab has been moved back adjacent to the pumps at the engine. The lifting of a hinged cover makes the valves easily accessible for inspection and service, and the amount of piping required is substantially reduced. Relocation of the valve manifold has permitted the redesign of the operator's cab, now equipped with an inclined front window and single-pane side windows for greater visibility. A 2000 lb counterweight at the inboard end of the main boom balances the extended portion of the telescoping boom and increases its lifting capacity by permitting more of the power input to act directly on the payload. All cylinders have been redesigned for longer life and simplified maintenance. Flexible hoses have been much simplified, also, with a minimum of exposed locations. Appearance of the Gradall has been streamlined in the redesign process. The gas tank has been sunk to the deck level for example, and the deck as a whole is cleaner, though heavier. A net increase of 2 tons in gross weight has resulted from the various design changes. The Gradall is now offered with a diesel power unit as optional alternate to a gasoline engine. **The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.**

Power Units

A COMPLETE NEW LINE of Ford industrial power units went into production in January. Five models are included in the line and are available in either open or enclosed versions. They will be offered complete with radiator, instrument panel and S.A.E. or Ford type housings, and will be equipped with skid type mountings. The units may be ordered with or without clutch, power take-off and three, four or five-speed transmissions. The new Ford industrial engine power units are flexible, compact and durable. They are built in the same plants and according to the same high standards which have characterized Ford passenger car, truck and tractor engines for nearly half a century. They incorporate the latest advanced engineering and design features intended to assure maximum performance and economy. **Industrial Engine Dept., Ford Motor Co., Dearborn, Mich.**

Hot-Mix Plant

A CONTINUOUS, BITUMINOUS hot-mix plant, the M-20, having a 20-ton per hr capacity, is now being manufactured. Known as the Wayne Monotrol Model M-20, it is designed for one-man control. All functions of the plant are electrically operated from a single control panel. Positive control of the quality of the mix is the most important feature of the new machine. Accurate proportioning and thorough mixing of the bituminous materials are insured by several patented mechanical devices. An individually controlled volumetric-type feeder valve for each raw aggregate bin compartment permits accurate proportioning in any specified percentage. A three-section rotating dryer prevents segregation and can eliminate up to 100% of the moisture if required. Constant accuracy of the bituminous mixture is maintained by several patented features on the hot aggregate measuring bin and bitumen pump control. The variable speed transmission permits changing the flow of the aggregate while the machine is in operation. For complete job data and other information, write **Wayne Crane Div., American Steel Dredge Co., Inc., Fort Wayne, Ind.**



Model M-20

Equipment, Materials & Methods (Continued)

Crushing and Screening Plants

PORTABLE CRUSHING PLANT—The single pass plant, a new crushing and screening plant, is made up of standard Cedarapids units and has been especially designed as a low investment machine for moderate sized crushing jobs. Recommended for use where the material is screened into only one size, the highly mobile plant can be set up close to the job-site to eliminate high hauling costs and provide a source of low cost gravel and rock for road maintenance work or small construction jobs. Extremely low operating costs and plant maintenance are claimed to be the result of simple design. Write for Bulletin SPP-1.

CRUSHING AND SCREENING PLANT—Known as the Hawkeye Series, the new line of Cederapids crushing and screening plants is designed to produce low cost gravel for road maintenance and small concrete structure jobs. The lightweight plant is 100% portable, with nothing to set up or take down when transporting, and can be moved with the job to the nearest gravel bank to eliminate high hauling costs. Depending on local conditions and specifications required, the plant produces between 50 to 75 tons of accurately sized material per hour. Complete information can be obtained by requesting Bulletin **Hawk-1. Iowa Mfg. Co., Cedar Rapids, Iowa.**

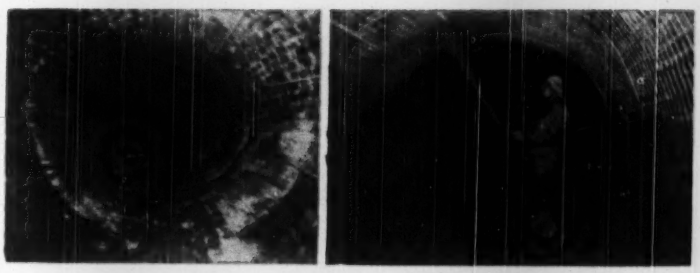
Press-Ur-Meter

A MODERN DEVICE using the pressure method for measuring entrained air in fresh concrete is the Press-Ur-Meter. Faster than any other meter, the Press-Ur-Meter following the Klein-Walker application of Boyles Law, simplifies the usual testing procedure using only about one tablespoonful of water, which is added on top of sample to insure accuracy. No adjustments for varying barometric pressures are necessary and with several built-in features, a complete test may be made in approximately three minutes. A direct reading in percent of air is made. No computations or special training is required to operate. Low in cost, light in weight (19 lb), capacity is $\frac{1}{4}$ cu ft. Accuracy of meter and gage may be checked as frequently as desired. A new folder is available covering admixtures and air entraining agents and thoroughly describing this air-meter. **Charles R. Watts & Co., 4121 Sixth Ave., N.W., Seattle 7, Wash.**

Hydraulic Control Unit

CAPABLE OF HANDLING any number of ram-operated attachments simply by adding additional valves, a new type of hydraulic control unit has been announced. Featuring pump, valves and tank in one unit, it is adaptable to all models of all crawler tractors. Control valves are provided with a float position, which allows

(*Continued on page 98*)



"Gunite" Strengthens Existing Sewers

Reinforced "GUNITE" lining has been successfully used on brick, tile and concrete sewers, restoring them to greater than originally designed strength.

Erosion of mortar joints and dislodged bricks made many sections of the above 65-year old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining of varying thickness in this sewer without opening the streets. Sewer service was maintained by installing temporary flumes and also by by-passing through relief sewers.

This job, and many other types of "GUNITE" jobs which we have done, are illustrated and described in our new 64-page general bulletin B2400. A request on your letterhead will bring you a free copy by return mail.

We will be pleased to cooperate with you on any of your problems.

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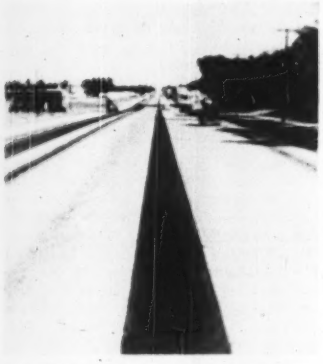
Equipment, Materials & Methods (Continued)

free circulation of fluid to both sides of the ram, without hydraulic lock. This feature is adaptable primarily for dozer operation. Valves are so designed that ram lag is eliminated. Cool operation is assured because of a large reservoir, permitting ample surface contact of hydraulic fluid for dissipation of heat. Pump capacities are from 25 to 65 gpm at 1000 rpm. Maximum recommended working pressure is 1000 psi. Complete specifications and prices on this hydraulic control unit are contained in Bulletin 396-ED, available from **Equipment Div., Kay-Brunner Steel Products, Inc., 2721 Elm St., Los Angeles 65, Calif.**

Concrete Stain

TWO FEATURES OF MAJOR importance—traffic safety and economical maintenance—have been incorporated in the construction of the new Federal-State Hillsboro Highway leading into Tampa, Florida. As illustrated, a 4 ft wide concrete division strip has been given a corrugated surface which, when driven upon, transmits a warning vibration to the driver



Stain Used on the New Hillsboro Highway Leading into Tampa, Florida

Also, in order that the division strip may be easily seen for long distances in advance, two saturate coats of Kemiko stain, unlike ordinary surface paints, penetrates into the pores becoming an actual part of the concrete. It is guaranteed by the manufacturer not to chip, crack nor peel. The result is a rich, black, permanent color which will withstand heavy traffic and varying climatic conditions for many years without need of further applications. This unique method of dividing and marking a highway is said to be not only more economical in that Kemiko is a permanent coloring, but it also provides an element of safety through the avoidance of hazardous curbs. For further information, regarding the use and application of Kemiko concrete stain, interested parties may write to **Rohloff & Co., 918 N. Western Ave., Hollywood 27, Calif.**

Equipment, Materials & Methods (Continued)

Electric Eraser

A THREE-PURPOSE ELECTRIC tool for architects, draftsmen, designers, schools and art studios is the latest addition to the power tool line of Dremel. Through the medium of a worm gear drive, power is increased and an ideal erasing speed of 3,000 rpm is achieved in the eraser to prevent burning or tearing of paper. Other features are a vibrationless motor to permit pin-point accuracy in erasing fine detail; light weight of only 12 ounces; sliding snap type switch for intermittant or continuous operation; quick-action chuck and a handy hanger hook. To increase utility value of the new tool, Dremel has incorporated a burnisher at opposite end of the eraser shaft. This ball point smoothes erased areas for perfect re-drawing or re-inking. A rotating abrasive disk at the base of the burnisher is an additional time-saving feature for sanding pencil or compass leads to needlepoint sharpness. The eraser is furnished complete with six foot rubber cord and plug, three grades of $\frac{1}{4} \times 3$-in. eraser tips, and six extra abrasive disks for pencil sharpening. **Dremel Mfg. Co., Racine, Wis.**

Bucket Loader

NEWEST ADDITION to the Barber-Greene line of portable "Constant Flow" material handling equipment, is the pneumatic-tired Model 543 bucket loader. An outstanding feature, especially to those who have widely scattered stockpiles, is the 15 mph road speed of the 543. Steering, through a truck type worm and roller, is as simple as driving your truck, and allows easy maneuvering in cramped places. Of practical design the bucket loader is an economical truck loading tool, ideal for aggregate producers, counties, cities, state highway departments, industrial plants, material yards, railroads. Two forward and two reverse speeds allow operator to compensate for material being handled and power requirements. High reverse gives fast out-of-pile speed to escape cave-ins. The 543 efficiently loads highest, longest trucks, long trailers, railroad cars, etc. with a minimum of spotting effort. It handles capacities of up to 3 cu yd per min. **Barber-Greene Co., Aurora, Ill.**

Compaction Roller

RECOGNIZING THE GROWING importance of compaction in highway fills, earth dams, etc., and the mounting problems of meeting compaction specifications on contract jobs, Huber engineers have designed a new roller to fill a wide range of compaction applications. The unit is a one-man, self-propelled machine engineered to give high compacting values. Thoroughly tested in more than a year of varied operations in the field, the roller has a per lineal inch compaction of 5,387 lb. It compacts

(Continued on page 100)

Relieving platform, which supports New York's East River Drive, rests on 72,000 creosoted piles. Wood form, pictured here, carries reinforced concrete slab.

72,000

CREOSOTED PILES SUPPORT NEW YORK'S EAST RIVER DRIVE!

New York's East River Drive, completed in 1942, is one of the city's most impressive waterfront parkways. This Drive is about 7 miles long; in six lanes, it carries two-way high-speed traffic. For a distance of 4.3 miles, relieving platform bulkheads were built along the shore of the East River to support the highway. These relieving platforms rest on approximately 72,000 creosoted timber piles, driven offshore in water 20 to 30 feet deep.

The engineers specified pressure-creosoted piles because of their economy and permanence. These piles are usually lower in cost than other permanent pile materials. The pressure-creosoting treatment protects them against marine borers; also, against decay and insect attack where cutoffs are above the water table.

When your projects require permanent construction *with economy*, Koppers Pressure-Creosoted Piles may be the best answer. Koppers Piles can be delivered on schedule, in lengths up to 130 feet. Write for quotations.

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.

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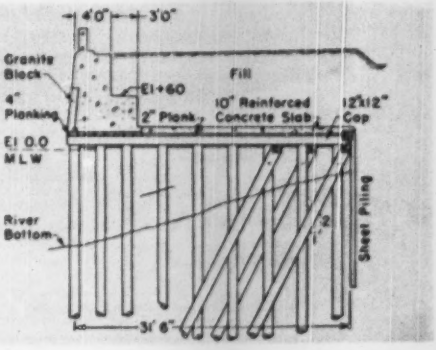
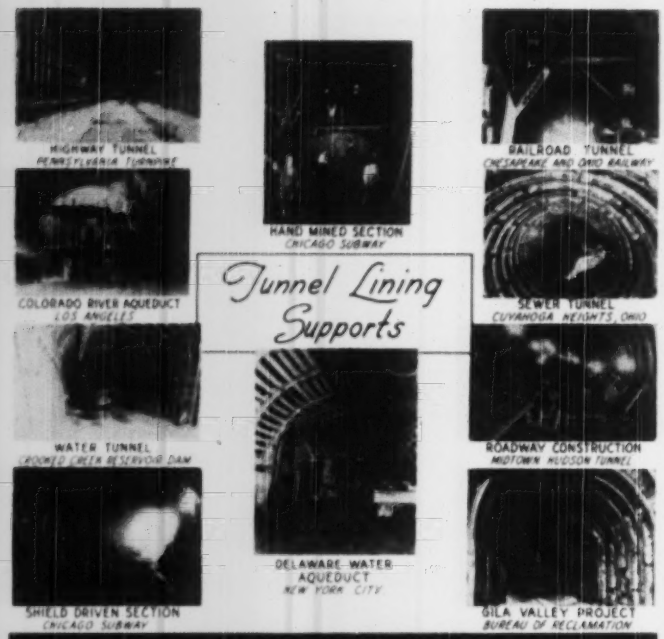
As reported in an article in Civil Engineering, April 1949, "Design is based on assumption that creosoted piles used will outlast other materials in structure."





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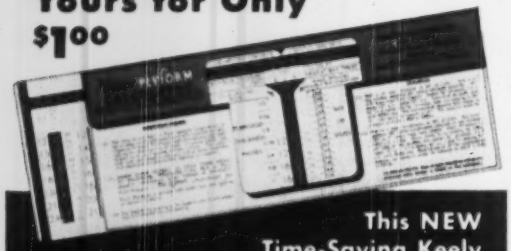

This NEW Time-Saving Keely PLYFORM CALCULATOR

SAVE time designing and building forms of PlyForm, the concrete form grade of Douglas fir plywood. Handy slide-rule calculator gives construction data, based on hourly rate of pour. Included is booklet, "Design Assumptions for New Keely Calculator." Clip coupon — now!

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Equipment, Materials & Methods (Continued)

4,100 sq ft an hr at an average speed of approximately two miles per hr. With a set of standard rolls, the Huber compaction roller can be converted to a conventional 12 ton 3-wheel type roller. The rear rolls of the compaction roller have a series of five scalloped ribs at the outer circumference. Each rib consists of 12 4-in. high scallops and the ribs are staggered from one row to another in such a manner that there is a high point every 3¼ in. The ribs are two in. wide and are spaced 2½ in. apart. There is an independent roll-cleaning scraper for each groove, providing assurance that the grooves will be free from dirt and that the scallops will give a uniform depth of pattern in the soil at all times. The compaction roller is described in Bulletin No. H-140. **Huber Mfg. Co., Marion, Ohio.**

Scoop-Shovel

A HYDRAULICALLY-OPERATED scoop-shovel which eliminates manual shoveling when scooping, lifting, moving, and dumping sand, coal, gravel, grain, dry chemicals and similar loose materials has been manufactured. The scoop-shovel accessory is attached easily to the Lift King and Worksaver electric and gas fork trucks for operation within the plant, in the plant yard, and in box cars and highway-truck trailers. The scoop handles up to 27 cu ft of material. It tilts upward from the horizontal scooping position to cradle the load during transport, and tilts downward to completely discharge the load when dumping. The device scoops at the ground level or digs into piled material. It dumps loads into bins, vats, hoppers, mixers, and other receptacles at heights up to 130 in. The scoop-shovel is designed to scoop up a full capacity load and to carry the load without loss in transfer. **Yale & Towne Mfg. Co., Philadelphia Div., Philadelphia, Pa.**

Electricontact Meter

AN INDUSTRIAL METER DESIGNED to replace volume measuring tanks and give rapid, accurate and automatic measurement of liquids for batch mixes is now available. Electrical contacts control the fluid content meeting formulae, humidity and temperature conditions of the industrial process. Actuating a solenoid controlled valve, the meter accurately regulates the amount of liquid in a given batch by shutting off the valve when the predetermined amount of fluid has been provided. Time is saved over the measuring tank process since the meter computes the liquid amount in less time than a tank can be filled. The meter is designed for use in the chemical, cement, food and similar industries using non-corrosive liquids in the manufacture of their products. Detailed information and adaptability of the installation for given conditions may be secured without obligation from the **Buffalo Meter Co., 2917 Main St., Buffalo, N.Y.**

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It is a widely known fact that Layne Well Water Systems, point for point, always measure "head and shoulders" above any other make. This means that there is no advantage whatever in buying the so called "just as good" equipment. Furthermore there is no use telling you that this or that Layne part is super-duper. What you are buying—and have every right to expect; is unquestionably good performance over a long period of years. That, in brief, is exactly what Layne offers without reservation of any nature.

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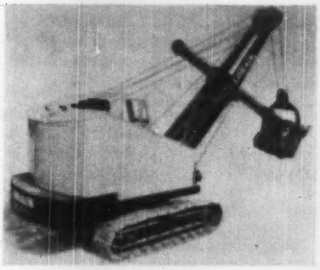
Equipment, Materials & Methods (Continued)

¾ Yard Lorain

A NEW MACHINE IN the ¾ yd class, known as the Lorain TL-25, is now available. The turntable design of the Lorain TL-25 is such that it is comprised of several major components. Each of these components is built on its own separate assembly line as an integral unit, complete with all subassemblies and parts installed.



The Lorain TL-25

Interchangeable front end boom equipment is provided covering the following equipment: shovel boom with independent cable crowd, all-welded shovel boom, one-piece dipper stick, ¾ yd streamlined dipper, crane boom in two sections with flanged bolted connections and suitable center sections and tip extensions for lengthening the boom, special features for standard lifting cranes include: Steel Erector's Precision Boom Lowering Device for variable speed, power-controlled boom lowering, swing brake and boom stops, a Third Drum attachment for lifting cranes is available as an extra, the Clamshell is equipped with a Rud-O-Matic tag line, the Dragline features a "cable-miser" fairlead, the Hoe has a gooseneck boom and a streamlined "non-heeling" dipper. Mountings for the Lorain include three crawlers, all of which are two-speed chain-driven crawlers with oil-enclosed propelling mechanism, and equipped with ratchet and pawl four-way tread and travel lock. Rubber-tire carriers are provided for the turntable in a wide series of types and models. The Thew Shovel Co., Lorain, Ohio.

Working Platform

WITH THE VERY APT NAME of the "Beanstalk," a new and handy tool has been announced. It is a one man operated working platform with a maximum height of 17 ft. This height allows the operator to work at positions of 22 to 23 ft from the ground. An extremely mobile equipment it can even be pushed through an ordinary door and easily maneuvred in confined passages and gangways. Recessed windows 9 in. back from the face of a wall can be reached comfortably while its base still provides ample stability. The secret of this tool's performance lies in the novel use of a triple hydraulic ram and a tubular

(*Continued on page 103*)

We sure lay it on the line with the

MICROTOMIC
"VAN DYKE"
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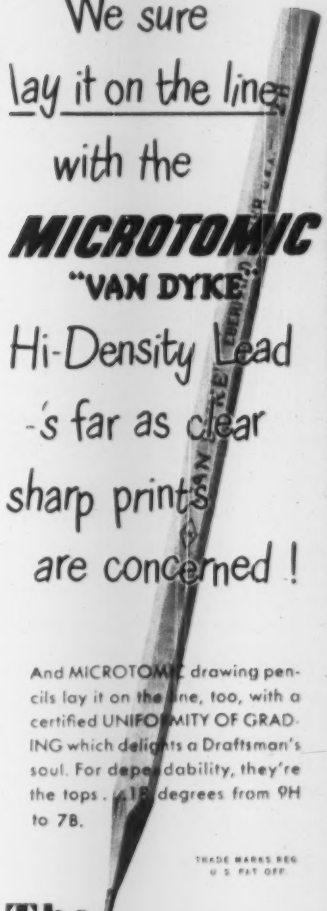

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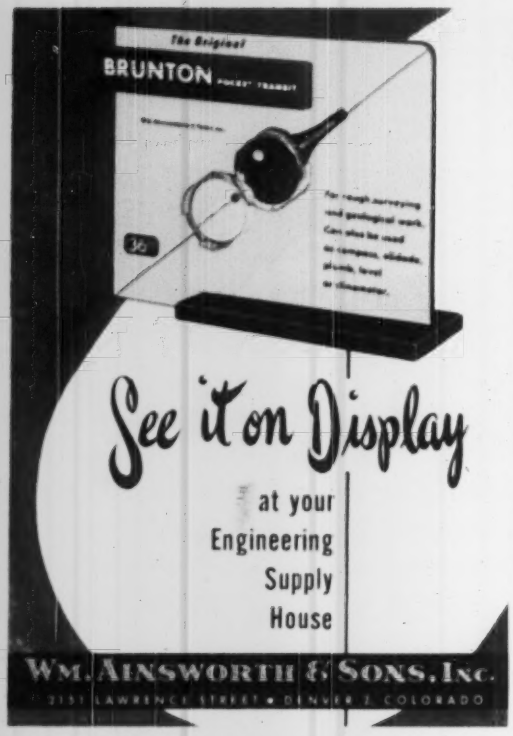

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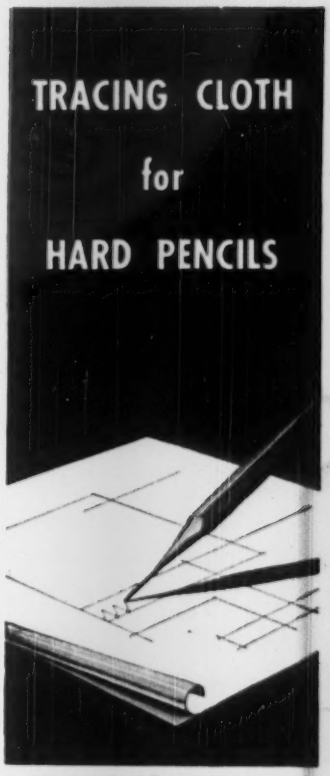

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COPPER SULPHATE—An attractive and interesting 24-page booklet describes in detail copper sulphate for root and fungus control in sanitary sewers and storm drains. This treatise has been prepared in response to numerous requests for information on this problem. Problems, solutions and comments are discussed. Several pages are dedicated to the application of sulphate as a guide to public works officials, sanitary engineers, sewage departments and other interested municipal officials. **Phelps Dodge Refining Corp., 40 Wall St., New York 5, N.Y.**

DIESELS—Two new bulletins containing complete specifications of all automotive and industrial models of HR-600 and HRS-600 diesels have been announced. Each bulletin includes general specifications, a list of standard equipment for each model, together with optional equipment. Installation drawings and photographs of the various models, plus drawings illustrating torque, horsepower and fuel consumption curves are featured in bulletin No. 5287 (HR-600) and bulletin No. 5288 (HRS-600). **Cummins Engine Co., Inc., Columbus, Inc.**

COMPRESSORS—"The Compressor of a Thousand Users" is the title of a 16-page catalog profusely illustrated with pictures of all sizes of the Joy WL-80 compressor, as well as sectionalized drawings to point out its various features. An interesting part of this catalog is a "Selector Chart" which makes it possible to choose a compressor according to individual requirements. The Duntair has been widely used as a power source in the construction, quarry, and public utilities markets. **Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22, Pa.**

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SHEET METAL INSTALLATIONS—A 23-page master specification guide to sheet copper installation is now available. Use of "Master Specification 100" is recommended in conjunction with "Copper and Common Sense," Revere's 96-page, profusely illustrated and detailed manual of sheet copper construction. With these publications, the company states that architects and sheet metal contractors can be sure of correct design and proper application. Write to **Revere Copper and Brass, Inc., 230 Park Ave., New York 17, N.Y.**

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ELECTRIC MACHINES—Publication of three bulletins describing the Marion Types 151-M, 4161 and 111-M Ward-Leonard electric machines has been announced. Numbers of the 2-color bulletins are No. 393-A for the Type 151-M, a 6½ cu yd unit; No. 394-A for the Type 4161, a 5 cu yd machine convertible to both shovel and dragline service; and No. 390 for the Type 111-M Ward-Leonard electric machine, which has been designed for continuous service in mining, quarrying, coal stripping, coal loading and large construction jobs. Copies of these three Marion bulletins may be obtained by writing direct to **Marion Power Shovel Co., Marion, Ohio.**

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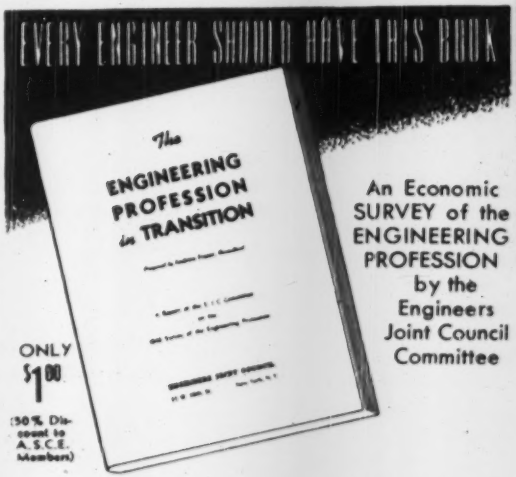

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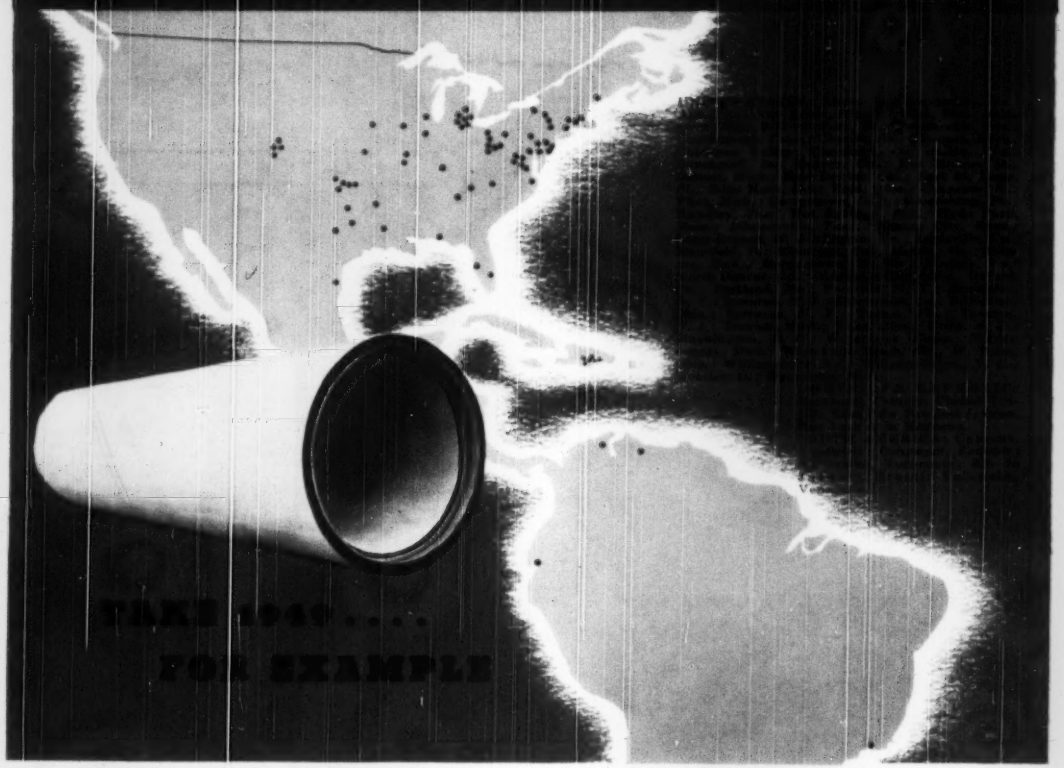

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